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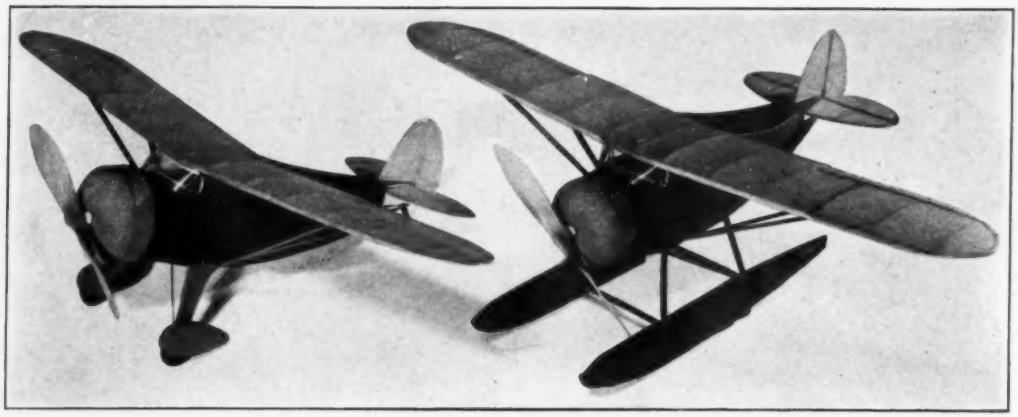

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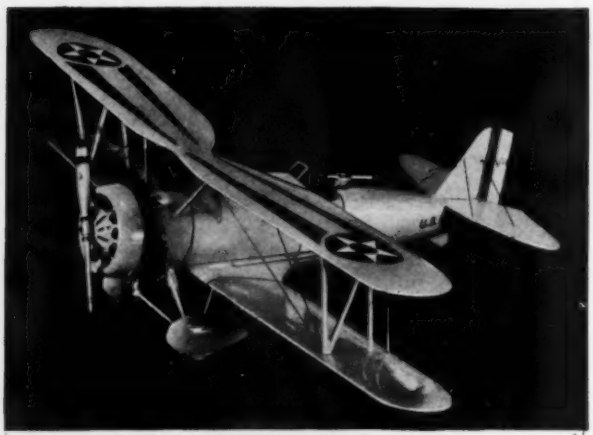

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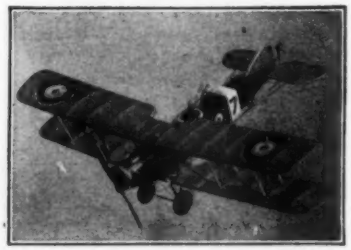

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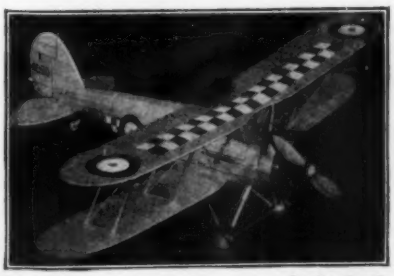

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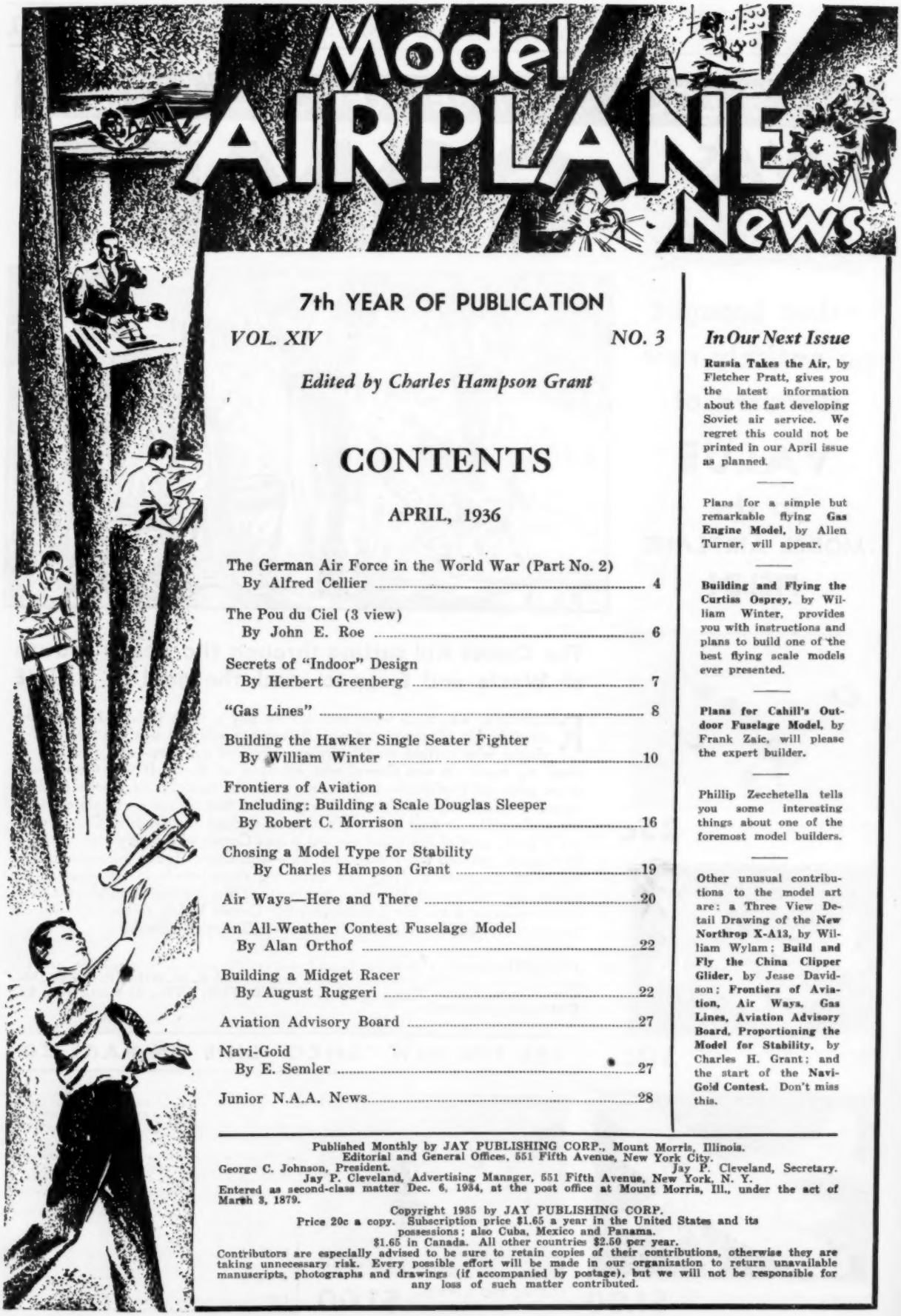


7th YEAR OF PUBLICATION

*VOL. XIV* *NO. 3*

*Edited by Charles Hampson Grant*

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APRIL, 1936



## *In Our Next Issue*

**Russia Takes the Air**, by Fletcher Pratt, gives you the latest information about the fast developing Soviet air service. We regret this could not be printed in our April issue as planned.

Plans for a simple but remarkable flying **Gas Engine Model**, by Allen Turner, will appear.

**Building and Flying the Curtiss Osprey**, by William Winter, provides you with instructions and plans to build one of the best flying scale models ever presented.

**Plans for Cahill's Outdoor Fuselage Model**, by Frank Zaic, will please the expert builder.

Phillip Zecchetella tells you some interesting things about one of the foremost model builders.

Other unusual contributions to the model art are: a Three View Detail Drawing of the **New Northrop X-A13**, by William Wylam; **Build and Fly the China Clipper Glider**, by Jesse Davidson; **Frontiers of Aviation, Air Ways, Gas Lines, Aviation Advisory Board, Proportioning the Model for Stability**, by Charles H. Grant; and the start of the **Navi-Goid Contest**. Don't miss this.

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"And between times I keep building my Aeronca Model. These Skymasters kits have everything in them. Why they even have movable control surfaces and aileron balances that operate just like a big plane.
"With my ready built Skymasters transport, I'm learning how to balance a ship for flight and when I finish my Aeronca model I know it will be a record breaker in its class."

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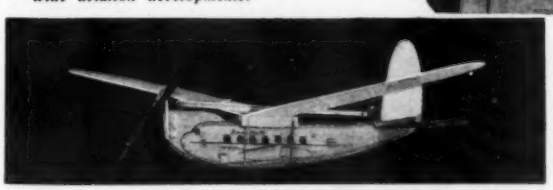
*Actual photograph 1936 AERONCA Model L-A in flight*



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German Aviatik training planes which fell into Allied hands and were painted Allied colors

# The German Air Force in the World War

## Intimate Details of the Thorough Training System Which Produced the Great German Air Fighters—Part Number 2

By ALFRED CELLIER

AS WITH all information concerning the German Air Service during war time, very little ever was let out either then or since that time. Their operations remain today a closed book, whether because they feel as a nation defeated in combat that it is nobody's business, or because the records were destroyed when Allied staff officers went to Berlin to check over their operations after the Armistice. Nevertheless, they had a strong air force in the field, a worthy foe and expert airmen to meet in combat. It is for this reason that so many are anxious to know the inside story of their training.

The training of pilots was done in the interior. It began in an aviation school, usually a civil school, or one of the many created by the airplane manufacturers. The finishing was done at a divisional depot squadron, called a Flieger-ersatz-abteilungen.

Up to the time of 1916, before air combat began in earnest, the pilots were required to pass three examinations before they were finished flyers or instructors and only two before they were eligible for a front line squadron. The first examination conferring the title of "Pilot" was obtained after making fifteen solo landings, landing in a circle fifty meters in diameter and making five figure eights

The second examination conferred the title of "Feld-Pilote", or Field Pilot, and these graduates were ready for air combat. This required landing in a circle fifty meters in diameter from a height of five hundred meters, a flight of a half hour at an altitude of three thousand meters with a spiral landing, and a flight of an hour's duration at three thousand meters.

To become a "Flugmeister" or Flying Master, it was necessary to pass a third examination. This consisted of making ten landings in a space one hundred meters wide from a height of eight hundred meters; ten landings in the same space from a height of two thousand meters; ten landings from four thousand meters with power off, and a flight of one hundred and twenty kilometers and return, over a prescribed course.

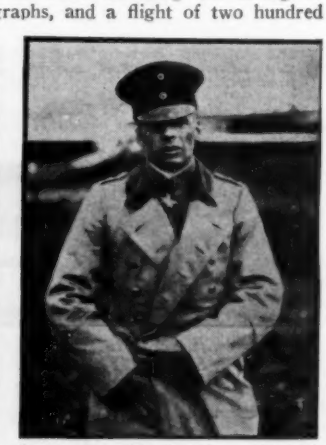
Like the youth of other nations, most of them were satisfied with the first two examinations in their desire to get active service. Toward the middle of 1917, with better equipment and the necessity for more finished pilot material, the examinations were tightened up. It was then necessary to take four examinations. The first two were in a civil school and the last two with a depot squadron. These remained in effect until the end of hostilities.

The first examination now required two flights making five figure eights and landing in a circle with a radius of twenty-five meters; the second, making five landings from five hundred meters, the signal to land being given by a pistol shot; ten landings from a height of eight hundred meters in a circle with a twenty-five meter radius; ten landings in the same circle from a height of one thousand meters with the engine stopped, and a flight of one hour at a height of more than twenty-five hundred meters. These examinations were given in an eighty to one hundred horsepower machine, and having passed them the student then went to a depot squadron.

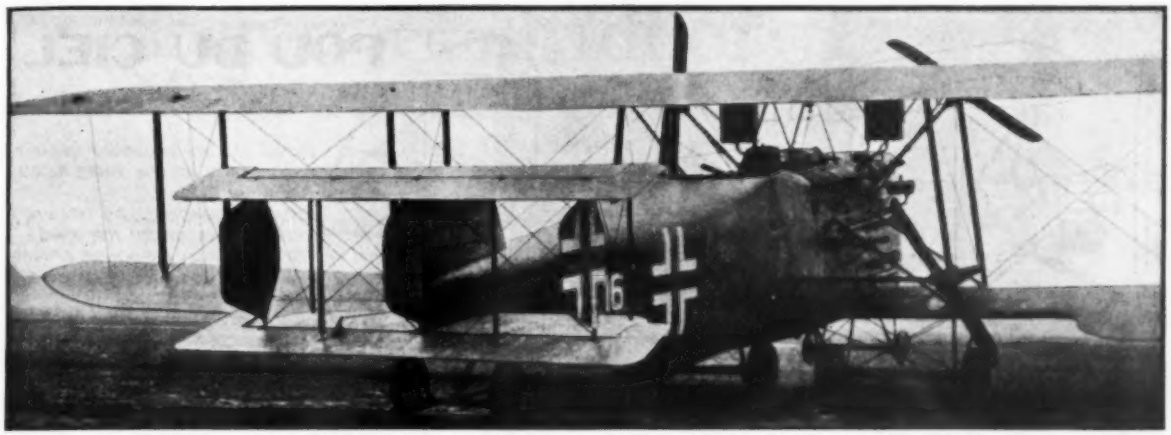
The third examination called for five landings from a signal by pistol shot, and five from a height of eight hundred meters; five landings from a height of one thousand meters and five landings in unknown country; two flights of one hundred kilometers, with an observer; four successive trials in aerial combat at a height of two thousand meters or more including the taking of photographs, and a flight of two hundred

Capt. Immelman beside a British plane he brought down (Nieto)

Ernst Udet in his Fokker D-8. He was a close friend of Von Richthofen (Nieto)



Capt. Oswald Boelcke with hi Fokker E-1 in the background



**A 1918 Albatross R01 bomber with four propellers driven by engines in the fuselage (R.R. Martin Photo)**

and fifty kilometers with an observer, landing during the trip. These examinations were given in machines of 120 to 160 horsepower.

The fourth examinations consisted of flights in different, new, high-powered, single and two-seater machines, with machine-gun firing during the flight. The training of the pilots lasted generally from five to six months. The pursuit pilots were usually selected from the pilots at the front. They were then returned for a special course of instruction in a pursuit school.

Observers also obtained their training at schools in the interior, or as more frequently the case, at Aviation Parks, in the North of France. Their instruction consisted of lectures on tactical and technical subjects and practical exercises.

Practical exercises consisted of flights with or without a tactical mission; machine-gun firing at ground targets and aerial combat lasting not less than fifteen minutes during which the observer took photographs of his opponent with a camera gun. The course finished with three examinations. These were the writing out of a report, reconnaissance work and ranging, and photographic reconnaissance and machine-gun fighting. The duration of the training took about two months.

Before the observer earned his brevet and was permitted to wear the insignia of an observer, he was required to have participated in twenty-five flights over the enemy lines; the taking of twenty-five photographs, and have been engaged in at least one aerial fight; to also make two night flights and two bomb dropping flights, and receive by wireless telegraphy sixty letters in a minute and be able to send forty.

The obtaining of personnel for the schools was carried out by the Reserve Training Section, known as the "Flieger-Ersatz-Abteilungen." Approximately 150 to 180 recruits were drawn from civilian employment for each Flieger-Ersatz-Abteilung every three months, preference being given to experienced workmen such as locksmiths, mechanics, turners, etc. In addition, men with technical knowledge from other branches of the Army who were no longer fit for active service, were drafted into the Flieger-Ersatz-Abteilungen. These far outnumbered the civilians, and it is impossible to know the figures in the latter case.

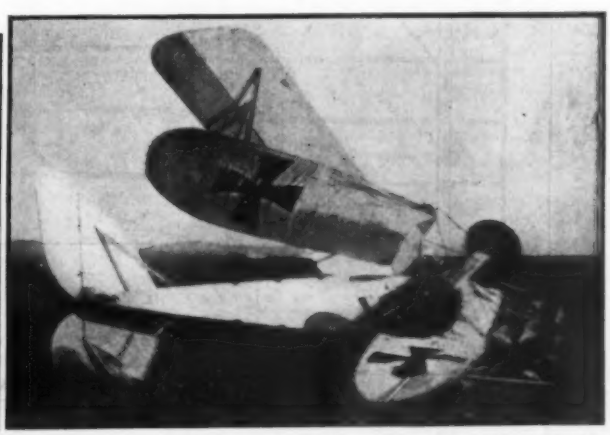
Flying personnel was drawn from the above mentioned sources as well as from officers and men who volunteered for the Air Service. Since volunteers were very numerous, it was possible to maintain a high physical standard. The medical examination was very strict, but apparatus for nerve testing was not used.

Pilots were trained in the Flieger-Ersatz-Abteilung and the Militar Flieger Schulen, or Military Flying School. The preliminary school was known as the "Vorratsschule." Pupils joining the Flieger-Ersatz-Abteilungen from other branches of the Army immediately entered the Vorratsschule, while civilians were first trained in the Rekrutenkompagnie, or recruit company. The course comprised lectures on engine construction, meteorology, the compass and map-reading; elementary practical instruction in assembling and dismantling of airplanes was given by mechanics under the supervision of a Werkmeister or Equipment Officer. The lecturers were all officers and N.C.O.s. The pupils stayed at this school on an average of from four to twelve weeks, according to the number of vacancies at the flying school. Owing to the large number of flying pupils a Vorratsschule was attached to several Beobachterschulen, or observers school, and Flieger Funker Schule or Wireless School. After passing an easy examination on the termination of his course at the Vorratsschule, the pupil entered either the Fliegerkompagnie or Flieger-Ersatz-Abteilung or was sent to the attached Militar Flieger Schule.

The Military Flying School was called a "Militar Flieger Schule." These schools were conducted by private firms; the training program being prescribed by the Inspektion der Flieger-turppen or High Command of the Air Service. An officer in

*(Continued on page 46)*

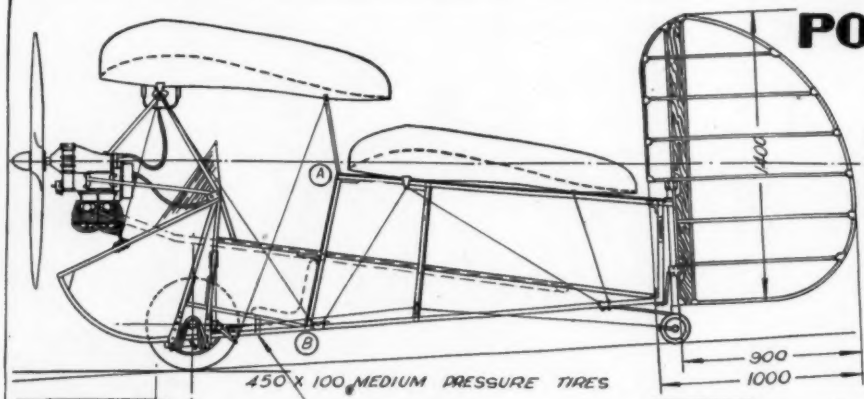
**A Salmson and its pilots of the 90th American Squadron, March 1918. Note the twin guns and insignia**



**A German A.E.G. after a crash at a German training school. Such incidents were a daily occurrence (R.R. Martin Photo)**

# POU DU CIEL

"SKY LOUSE"



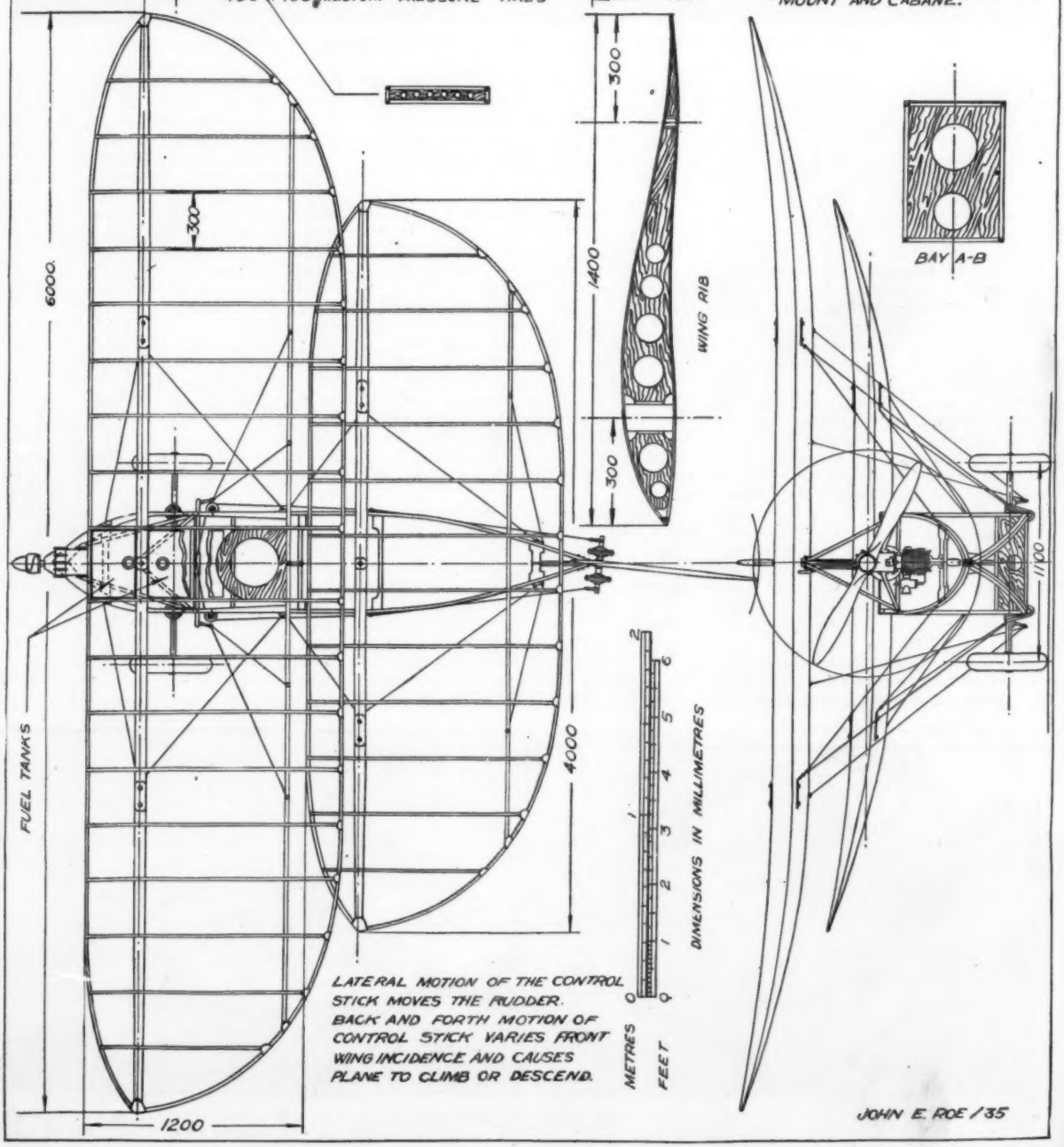

DESIGNED BY M HENRI MIGNET AND SHOWN AT THE PARIS AERO SHOW IN 1934

ORIGINAL MODEL, AS DRAWN, POWERED WITH 22 H.P. TWO-STROKE AUBIER-DUNNE ENGINE.

FUSELAGE ENTIRELY COVERED WITH PLYWOOD.

WINGS AND RUDDER FABRIC COVERED.

WOOD CONSTRUCTION THRU-OUT, WITH STEEL TUBE MOTOR MOUNT AND CABANE.




LATERAL MOTION OF THE CONTROL STICK MOVES THE RUDDER. BACK AND FORTH MOTION OF CONTROL STICK VARIES FRONT WING INCIDENCE AND CAUSES PLANE TO CLIMB OR DESCEND.

JOHN E. ROE / 35

# Secrets of "Indoor" Design

## Suggestions Concerning the Design and Arrangement of Required Parts That Will Improve Yet Simplify Your Indoor Planes

By HERBERT GREENBERG

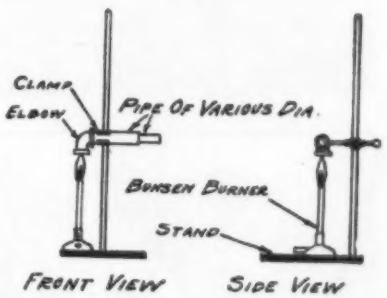
MANY model builders who live in small towns and at a distance from the large cities are handicapped in not being able to view the new designs and ideas of builders who attend the contests. It is obvious that if these fellows were able to follow the development of the indoor model, they would improve on their own designs and in many cases secure a new technique. This article is intended for those fellows and it is the writer's hope that this contribution will help bring out some new talent in the ranks of the indoor model builders.

The discovery of new materials and new methods of construction has simplified model airplane building to a great degree. Moreover, the time that is required to build a model has become less because of the new developments, and consequently model builders are able to devote a major portion of the time spent with their hobby to the flying of their creations. Changes in design and construction of indoor models have been due mainly to the development and application of microfilm to the science of model aeronautics. The physical characteristics of microfilm are such that new types of framework have been made available and practicable.

During the past three years, model builders have been using a number of different types of wing design. Wings with single dihedral and others with polyhedral angle are very common. The methods of constructing the framework and covering it are diverse. Some builders construct their wings in sections. If a polyhedralled wing having two bends is made, then three parts are constructed, covered, and finally cemented together at the desired polyhedral angle. Most model builders who use single dihedralled wings, construct each half separately, cover, and then glue the two halves together. It is significant that, no matter what type of wing is used—polyhedralled or dihedralled—one method may be used in each case. In other words, the making of wings may be standardized. The method which will be described has been used by comparatively few builders, and hence will be presented for the benefit of those unacquainted with the method.

The first step in the procedure is the drawing of the pattern. It is necessary that in order to secure a perfectly aligned framework, the wing spars and ribs be glued together over a pattern. Preference should be given to the elliptical type frame, because of its aerodynamic efficiency. An ellipse is easily drawn from instructions given in any descriptive geometry book. After the wing area and span are determined, the greatest chord which is found at the middle of the wing, may be calculated by substituting the values of A and b in the formula $A = \pi ab$, where A is the wing area, b is half the span, and a is half the maximum chord, and $\pi$ (pi) is equal to 3.14.

After the pattern has been completed, the ribs and spars which will comprise the structure should be cut out and shaped. The entire length of the leading edge is made in one piece. The trailing edge is likewise one piece. No steps need be taken to put in dihedral or polyhedral until the wing has been built and covered. By making the main spars in one piece, one may obtain a stronger and more



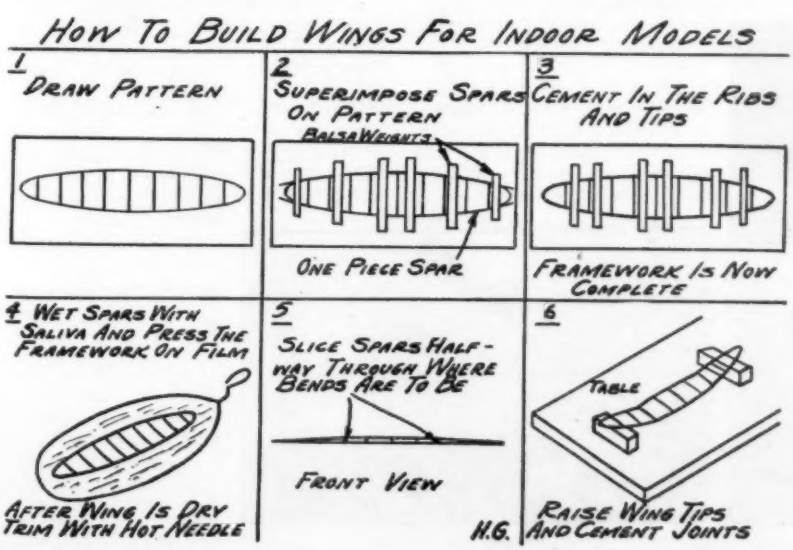

symmetrical framework. The time required to complete an R.O.G. wing, including covering, is about two hours if this procedure is followed.

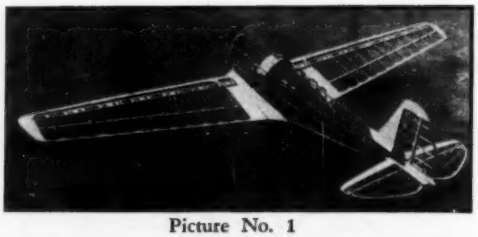
The sanded spars are next placed on the pattern and held in place with rulers or blocks of light balsa placed across the tops of the spars. After the shape of the balsa outline has been checked for symmetry, the ribs may be cemented in place. Wing tips are bent and glued to the ends of the leading and trailing edges with butt joints. This completes the framework.

The wing is now ready for covering. A sheet of flexible microfilm should be selected for this job. It should be a few inches longer and wider than the wing in order to insure ease of handling. The outline of the wing and the ribs where a bend is to be made for dihedral, should be slightly wetted. The framework is then laid on the sheet of film and gently pressed on to aid the film in sticking to the spars. After the moisture has evaporated from the wing, the latter may be removed from the sheet of film by trimming with a hot needle. The wing is complete except for a dihedral or polyhedral angle which may now be put in. At the points where the bends are to be made, the spars should be sliced through halfway with a razor. The wing tips are then raised the desired amount and cement is placed at each bend. After the bends have dried, the wrinkles in the film may be removed by running a hot needle back and forth at a distance of about half an inch beneath the surface of the wing. A beautiful-looking wing may be built if this procedure is followed and the advantages derived are easily seen.

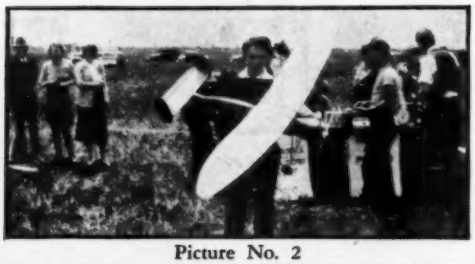
One of the most difficult operations in the building of a wing is the making of wing tips. There are a number of different methods in use, such as bending the wood around a heated funnel, electric light bulb, tin can, kettle spout, or cardboard form. One of the best ways to secure identically shaped tips is to bend a strip of balsa around a hot pipe or soldering iron and then slice out the two tips from the bent strip on a balsa wood stripper. The wood must first be moistened with hot water before bending. During the bending operation, the strip of wood must be moved across the top

*(Continued on page 42)*



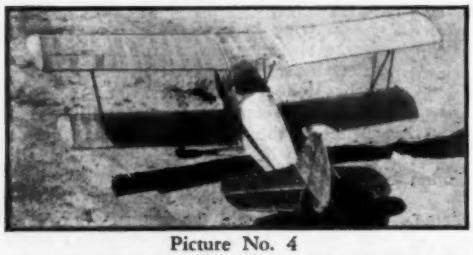


Picture No. 1

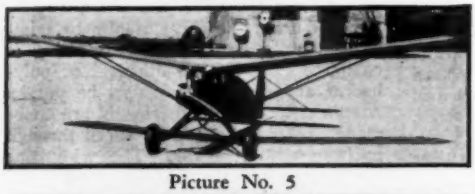


Picture No. 2

Picture No. 3

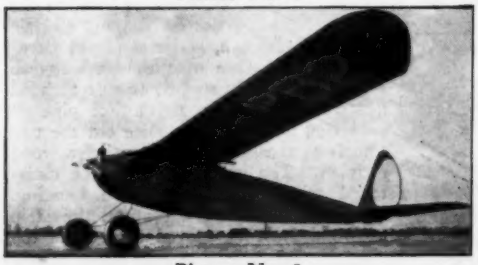


Picture No. 4



Picture No. 5

Picture No. 6



Picture No. 8

# "Gas Lines"

## A Presentation of Who's Who in Gas Model Airplane Designing, Building and Flying. Tell Others What You Are Doing

### JOIN THE I.G.M.A.A.

AT LAST we have a gas model organization. The International Gas Model Airplane Association, sponsored by MODEL AIRPLANE NEWS, has been formed and is at present busily engaged in organizing all gas model builders and organizations under its banner. This organization is to be a parent organization of many units. Units are to be established in every state. In fact, in some states several units will be organized.

Its purpose is to promote the activity of gas model airplane building in all its phases and in this way provide intimate knowledge of airplane design and construction and motors so that young men may have a clear conception of problems of aviation before they undertake their life work in this field. Hereafter "Gas Lines" will be devoted chiefly to news of the I.G.M.A.A. members. It will be their "mouthpiece," so to speak.

We suggest that all individuals or groups of individuals who are at present interested and active in this sport communicate with this office concerning this organization. Applications are at present coming in at a great rate, and the Association can now boast of several hundred members. The benefits will be many. There will be an exchange of helpful news and hints on design, construction and operation of gas models through the medium of "Gas Lines" in MODEL AIRPLANE NEWS.

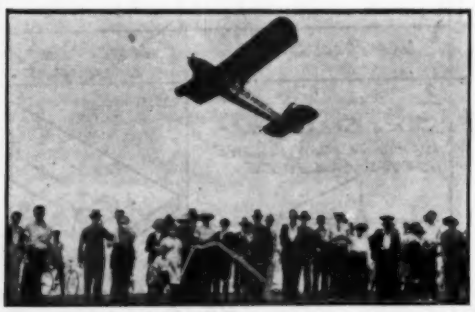
All members will receive membership cards, a list of the by-laws of the organization and rules governing contests. There will also be directions on how to form clubs or units, as well as how to carry on a unit successfully. Interesting features for club meetings can be had for the units by request from the sponsors. At present, sources of interesting moving picture films are being scouted out, so that club units can run these films at a reasonable figure to help make their meetings more interesting and instructive. Contests will be held regularly.

The International Gas Model Airplane Association is pleased to announce that Mr. Nathan Polk has been appointed Field Director of the organization. He is now busily engaged in breaking the news to many builders interested in gas models throughout the country and in promoting gas model activities intensively in the New Jersey section through the energy and foresight of Mr. E. B. Berlinrut of the "Newark Sunday Call." The first unit of the organization has been established under the guidance of the "Newark Sunday Call" newspaper. This unit will sponsor the activities in the state of New Jersey and Mr. Berlinrut has been appointed State Director. At present he is undertaking the organization of all model builders in the vicinity of Newark. Regular meetings will be held at the Newark Y.M.C.A. The first meeting was held on February 19th. The magazine went to press before the results of this meeting could be obtained. However, the next issue will carry important news concerning it.

The first gasoline model airplane contest sponsored by the I.G.M.A.A. and under the direction of Mr. Nathan Polk, Field Director, will be held at Hadley Field, New Jersey (near Plainfield) on Saturday, May 9th.

A list of the members who have sent in their application up to the time of this writing may be found at the end of "Gas Lines." Anyone wishing to join or form a unit may write to the International Gas Model Airplane Assn., MODEL AIRPLANE NEWS, 551 Fifth Avenue, New York City, or Mr. Nathan Polk, Field Director, 263 Halsey Street, Newark, New Jersey.

Now we have some interesting news from the builders.



Picture No. 15

As far as looks and construction are concerned, the prize gas job presented this month is built by N. Kanazik in Russia. It is shown in picture No. 1. This clearly demonstrates that Russian model builders are not lagging in the race for miniature air supremacy. We have Mr. Andrew Borysko to thank for the presentation of the picture.

**There are hundreds of fans throughout the world, each with some knowledge that would be helpful to other fans. Therefore, in order that a free exchange of ideas may take place with the ultimate result of an increase in knowledge of each individual, "Gas Lines" has been born. In its "Lines" each month "gas" modelers will read what the "other fellow" is thinking and doing. We urge everyone interested in this sport to join the I.G.M.A.A. and to contribute some news, pictures or features of interest and value so that through this exchange the aeronautical knowledge of those who will rule aviation in the future will be developed to a high degree. With all of this greater joy and interest will come to each individual.**

Picture No. 2 shows Leo Weiss with his model, which took first place at the National Competition held in St. Louis last June. During his stay at M.I.T., Leo is residing at 390 Malboro Street, Cambridge, Mass. This model was very unusual in design from many standpoints. First of all, it had very little dihedral. Its wing loading was fairly high and it was completely covered with balsa wood. The whole job was very well streamlined.

Arthur James May of 123 Lipton Street, Winnipeg, Man., Canada, sends us picture No. 3, which shows his tapered wing gas job. He says:

"I have never seen a tapered wing gas job in MODEL AIRPLANE NEWS, and inasmuch as I have the only gas model in Manitoba, and the only tapered wing job in Canada, I thought you would be interested in seeing it. It has a span of 10', ¾". The wing tapers from sixteen to eight inches. The wings are all built up with Warren-trussed bracing. It is powered with a Brown Jr. motor and took three months to complete."

May says test flights will be made "as soon as our thirty degrees below weather moderates."

An airplane with which few model builders are familiar is Wiley Post's biplane. Robert More of 154 East Norwich, Columbus, Ohio, has built a gas model of this ship to exact scale. The fuselage and wing spars are made of doweling. The interplane struts are white pine and the rest of the framework is of balsa. From the cockpit forward, the ship is covered with sheet balsa, including the wings. The rest is covered with silk. It required two and a half months of solid work to build it.

An exceedingly neat cabin job is shown in picture No. 5. It was built by Walter A. Rauch of 2848 North 29th Street, Milwaukee, Wis. It is extremely interesting from several standpoints, for Mr. Rauch says:

"The picture was taken at the Curtiss-Wright Airport in Milwaukee. This plane was designed and built before I saw either the Brown Jr. motor or any other gas job or plans for one. The plane has a 7½ foot wingspan. It is of all-balsa construction with metal fittings. The covering is of bamboo paper. The finished plane weighed 4¼ pounds. The leading edge of the stabilizer is pivoted and a screw adjustment at the trailing edge makes regulation for flight very simple.

"The first flight was three and a half minutes on which only ⅛ ounce of gas was used. Since that time the model has flown in all kinds of weather, even in high winds. Under all these conditions it gave very good performances."

Bob File of 502 Seymour Avenue, Columbus, Ohio, our old glider expert, has been infected with "gas jobitis". He has written us and told us of the ten foot KG which he has built. Picture No. 6 shows Bob with the framework of his ship. He has done a swell job on it. Entirely covered with two coats of color it weighs 4¾ pounds without the motor. With a motor the total weight is about 6⅛ pounds. The only reason is has not been equipped with the motor as yet is because there is no motor, he tells us. However, Bob soon expects to have one. He says:

"The ship has shown a glide of 18 to 1 in tests.

"We have quite an active club here under the name of the 'Advanced Model Aviation Society' and hold regular meetings every two weeks. At present 'gas models' are the principal interest and from present indications there will be at least five ships in the air by this spring."

One of the finest-looking jobs we have seen to date is shown in picture No. 7. This is a model that was built by Harry Edward Moyer of 612 Walnut Street, Lebanon, Pa. He says:

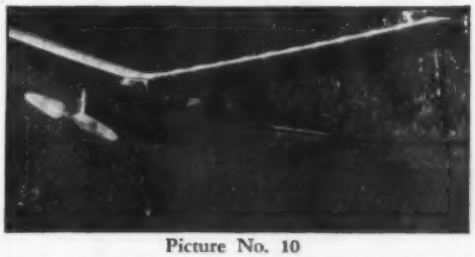
"It is not a contest model though I have kept the weight down to three pounds, three ounces. It was built just for a bit of model flying when we go out in the evenings or when time permits."

(*Continued on page 37*)

Picture No. 16

Picture No. 7

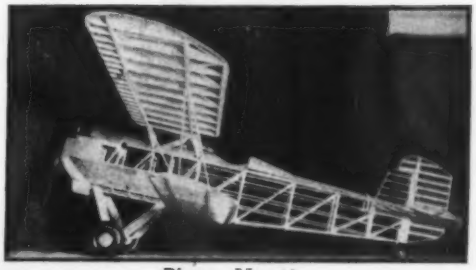

Picture No. 9



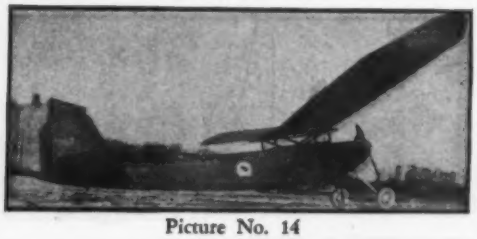
Picture No. 10

Picture No. 11

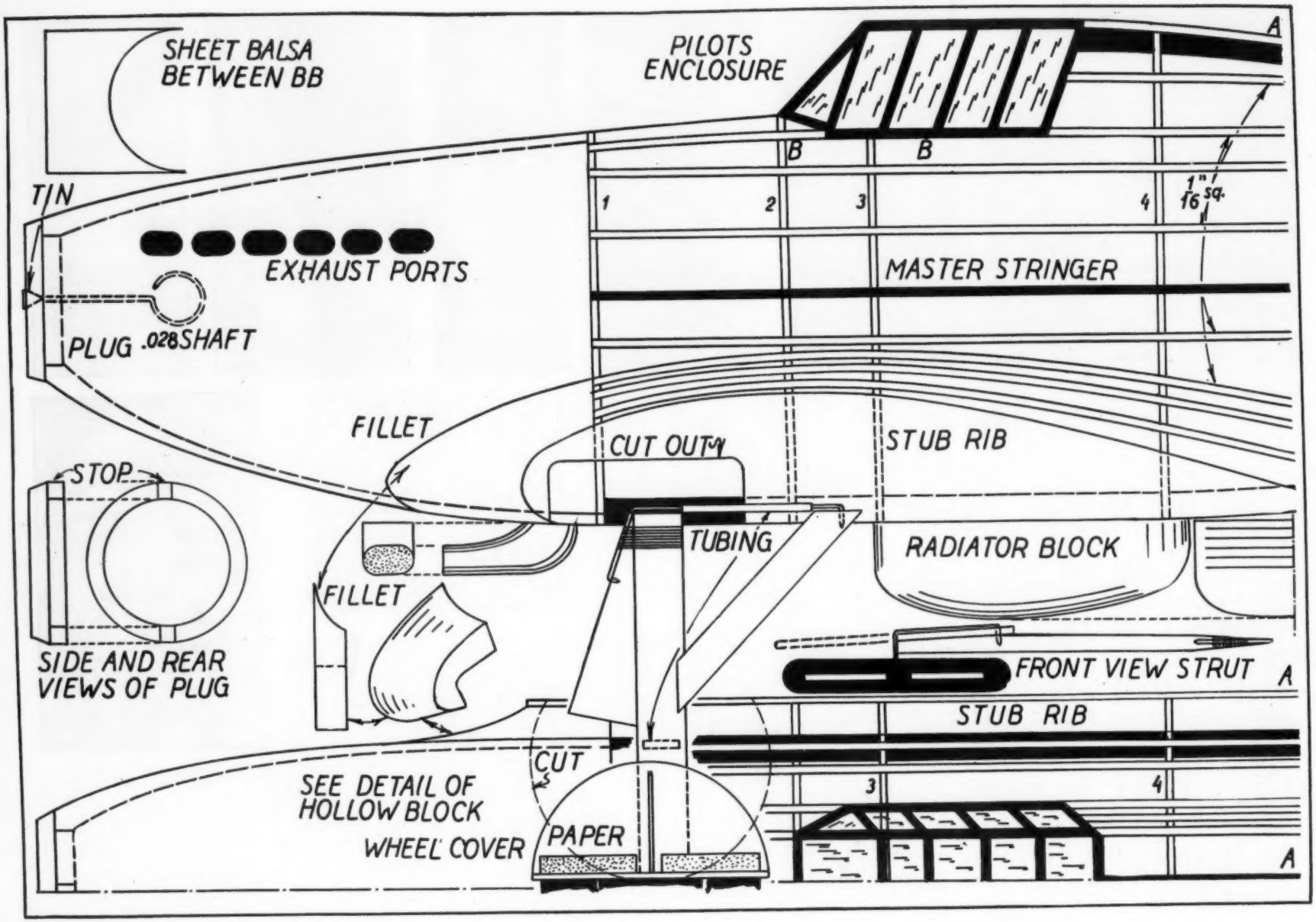
Picture No. 12



Picture No. 13



Picture No. 14


SHEET BALSA BETWEEN BB
PILOTS ENCLOSURE
A
B
B
TIN
1
2
3
4
1" sq. 16
EXHAUST PORTS
MASTER STRINGER
PLUG .028 SHAFT
FILLET
CUT OUT
STUB RIB
STOP
TUBING
RADIATOR BLOCK
FILLET
SIDE AND REAR VIEWS OF PLUG
FRONT VIEW STRUT
A
STUB RIB
CUT
SEE DETAIL OF HOLLOW BLOCK
3
4
PAPER
WHEEL COVER
A

# Building the Hawker Single Seater Fighter

## How You Can Create a Flying Model of Britain's Latest Fighter From the First Plans of It Ever Published

By WILLIAM WINTER

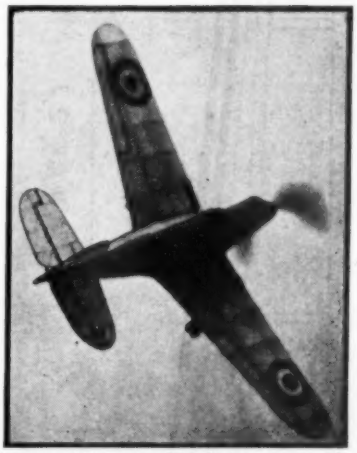
The finished model is very sturdy and realistic

EVERY Englishman is keenly alive to the potential horrors of a future air raid. Since necessity is the mother of invention, the famous interceptors have been evolved. They are built for tremendous speed and climbing ability. It is their military mission to nip any threat in the bud.

The new sensational Hawker is a low-wing monoplane of cantilever construction powered with a Rolls Royce "Merlin." The undercarriage is retractable. Naturally, wing flaps are incorporated in the design.

One glance at this latest British creation would justify an estimate of three hundred miles an hour. Although all data has been withheld, it is knowingly said that the horsepower is probably one thousand.

The model has been worked out right down to the retractable landing gear. The constructional method employed, by using four master stringers cut from sheet balsa, enables an accurate frame to be built with minimum effort and time.

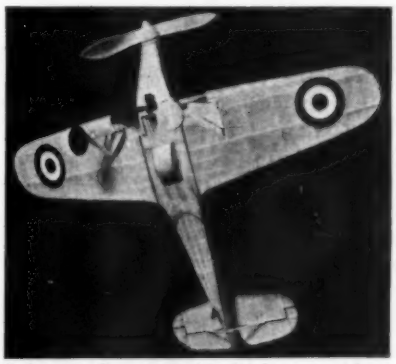


The model snapped in flight in a speedy climb

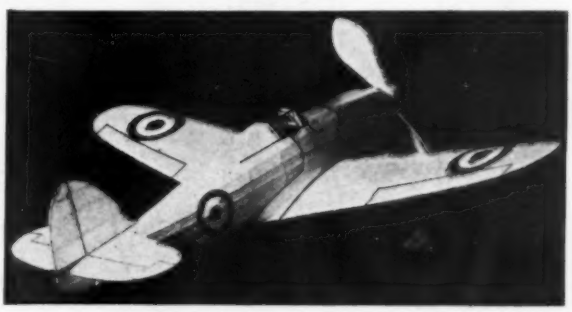
### Fuselage

Trace the top, bottom and sides of the fuselage on 1/16" sheet. Cut each master stringer thus traced about 3/16" wide. After cutting, mark on them the positions of the bulkheads. The bulkheads are also cut from 1/16" stock. The four main notches cut for the master stringers are 3/16" deep. Before attempting to cut all the notches shown, it is essential that their positions be accurately marked. Place the two side master stringers in place on the widest bulkheads. When the cement has set, locate the remaining bulkheads. Check the alignment before cementing the remaining stringers in postion. All auxiliary stringers are 1/16" sq. The rudder post is ⅛" sq. and supports the rear hook of .028 wire. The pilot's enclosure is a framework built up of 1/16" sq. A small former, the pattern of which is given, forms the rearmost piece of the enclosure. A pattern is also given to be used in making the small 1/16" internal former that is located at BB.

The nose block is carved from a block 4¼"x3 1/16"x2⅜". Before shaping, cut to the upper and side profiles. When the outer carving has been completed, the block is cut in half so that each half can be hollowed out. Cement the finished halves together and sand the outer surface to a fine finish. Cement the nose block to No. 1 bulkhead. The portion that has been cut away on the lower surface at the rear of the block coincides with the cut-out on No. 1 bulkhead. The bottom of the fuselage is covered with 1/32 sheet back to the third bulkhead. The bottom is also cut out so that the total cut-away is round to house the retracted wheels.



It boasts of a retractable landing gear that actually operates



In spite of details it is an excellent flier

Cut two ribs from 1/16" stock similar in shape and size to No. 1 rib. These two stub ribs are glued to the extensions of the bulkheads.

The tail wheel is mounted on an axle of .014 wire. The axle is bent so that it is imbedded in the lower master stringer at the correct position.

The stabilizer fillet is a sheet of 3/32" balsa cut to shape and cemented permanently to the fuselage frame. The stabilizer halves will later be attached to this fillet. Be sure that the incidence of this block is 1/16" negative.

The covering is of white tissue. Cut the paper into strips of a width that will permit the covering to be done without wrinkles. The finished covering is lightly sprayed and doped. Trim the edges of the pilot's enclosure in black. The circles shown can be obtained at any supply house.

Cut the small front fillets to shape and cement between the stub rib and the nose block. A portion of the fillets are cut out to fit the retracting gear.

### Tail Surfaces

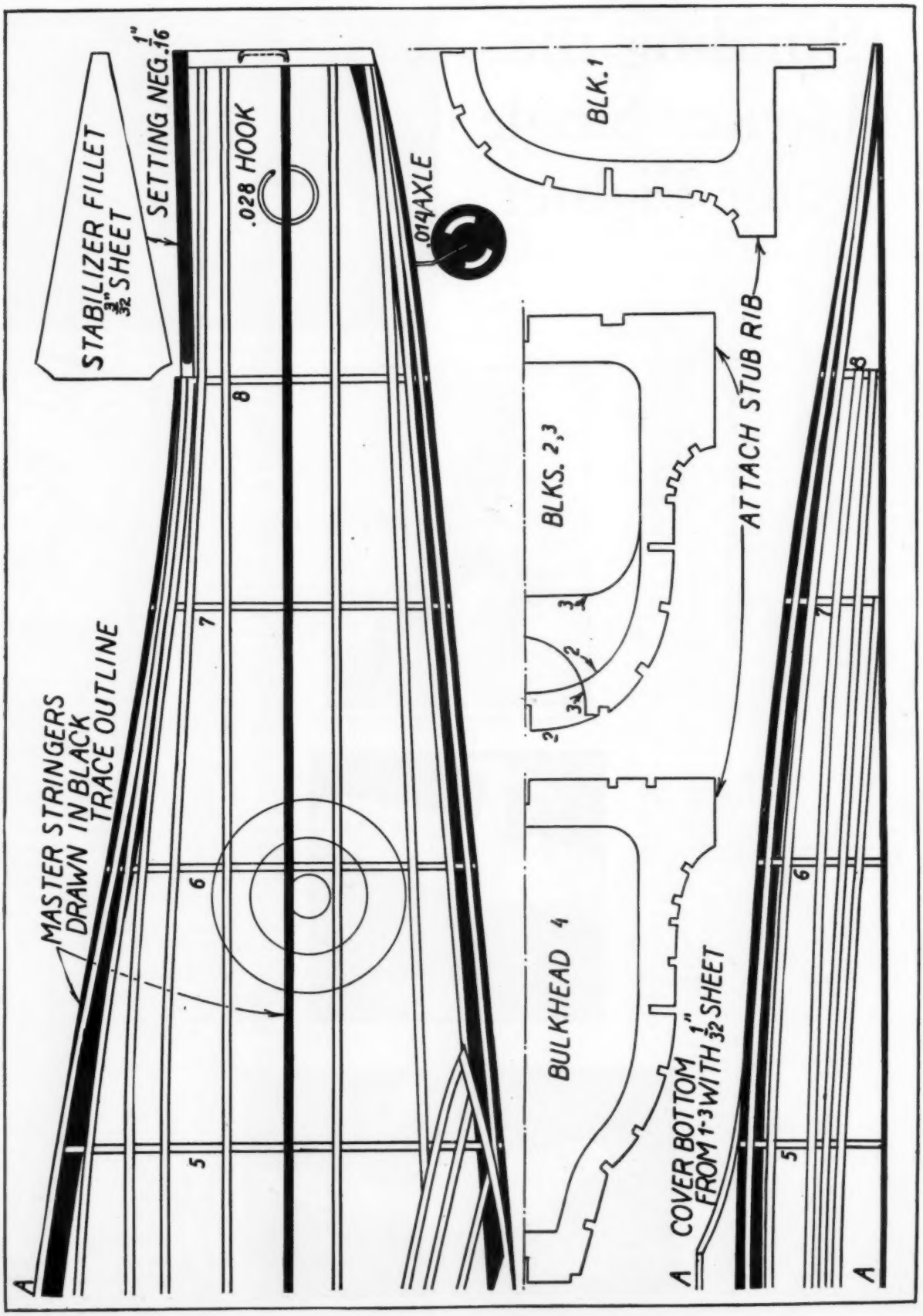
The framework of the tail surfaces is of 3/32" sq. The edges of 1/16" sq. bamboo are bent by heat to the required shape.

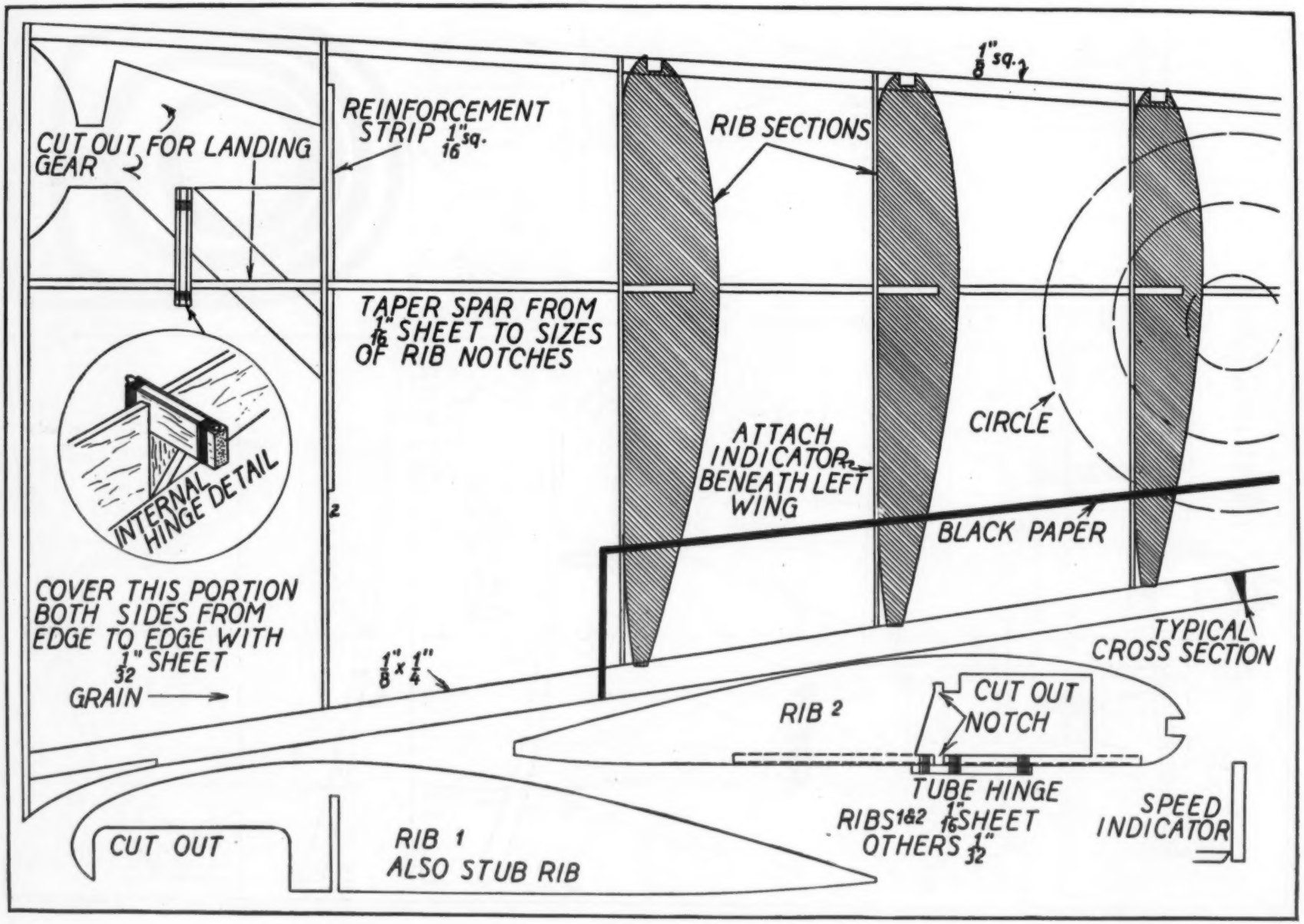
Each side of both stabilizer halves and the rudder is covered with an individual piece of tissue. Doping is sufficient to draw the paper tight. The control outlines are marked by narrow strips of black tissue. Small struts the size of which are given on the plan, support the stabilizer halves.

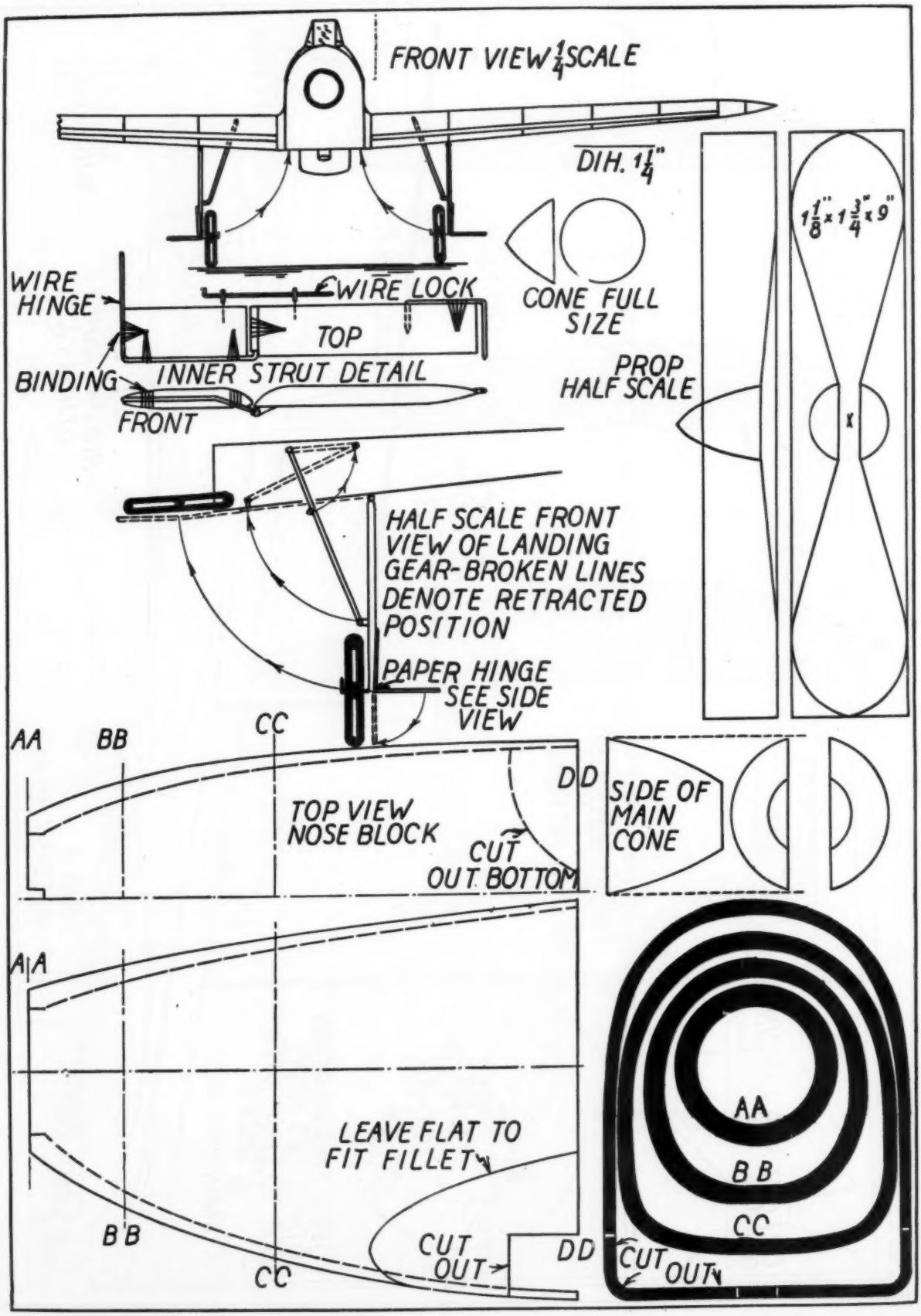
### Wings

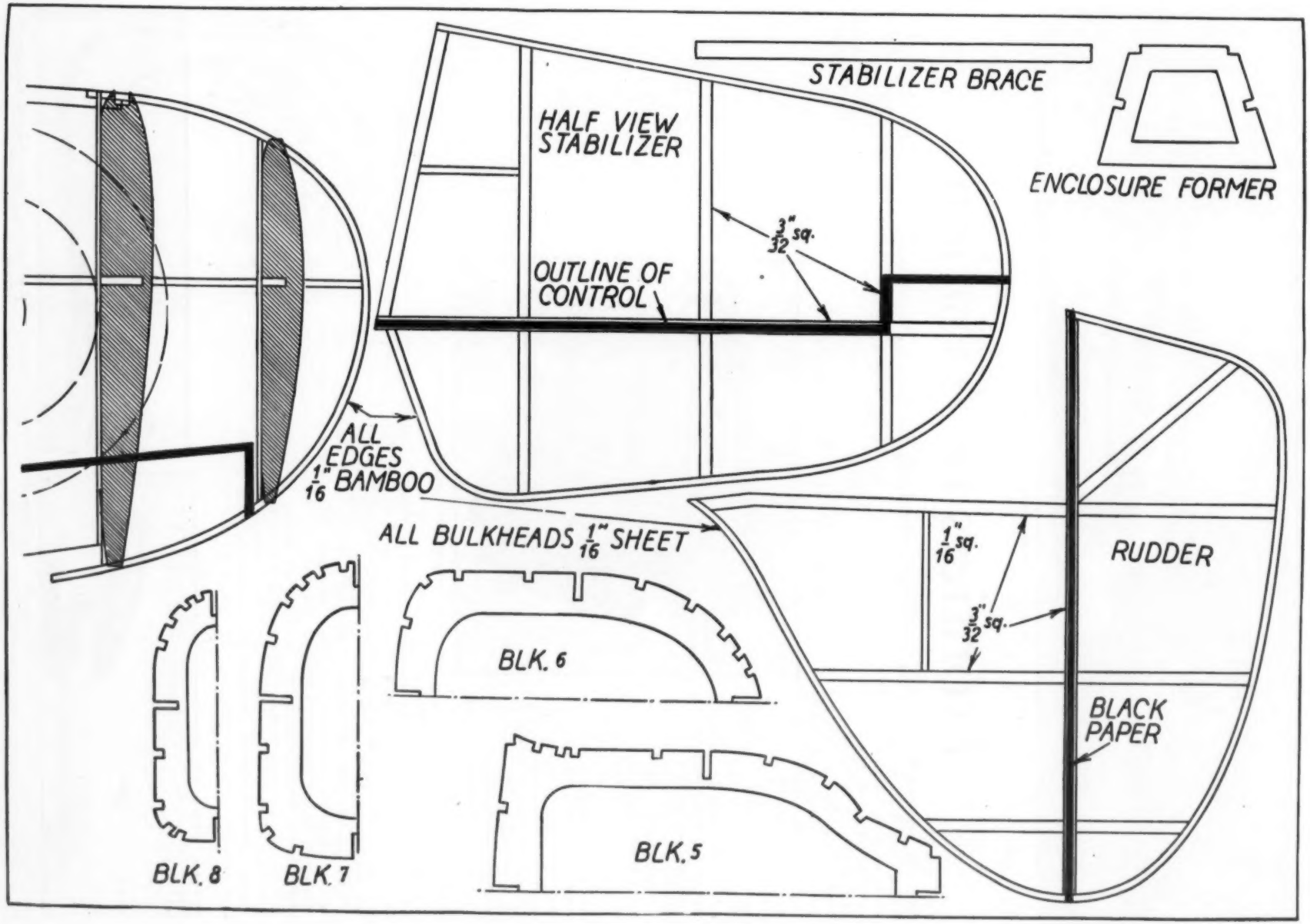
Cut the ribs to the required shapes using the patterns given. The stub ribs as well as the first

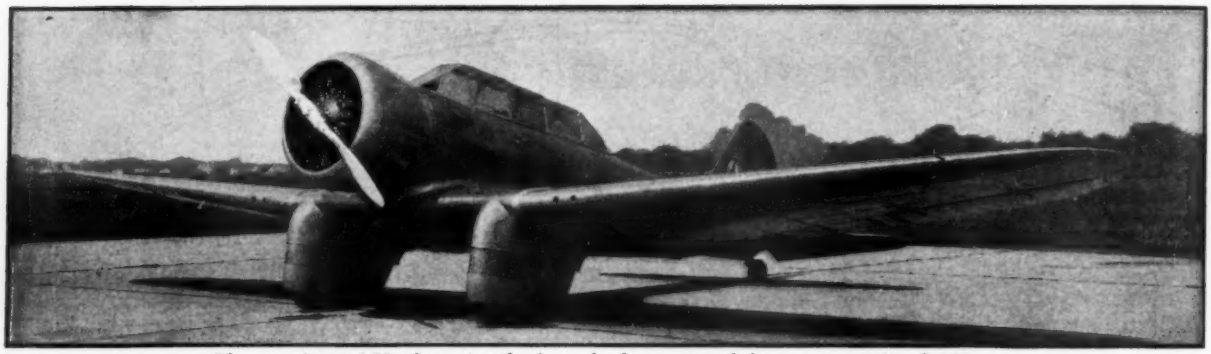
*(Continued on page 41)*


STABILIZER FILLET 3/32" SHEET
SETTING NEG. 1/16"
.028 HOOK
.014 AXLE
BLK. 1
BLKS. 2,3
ATTACH STUB RIB
MASTER STRINGERS DRAWN IN BLACK TRACE OUTLINE
BULKHEAD 4
COVER BOTTOM FROM 1-3 WITH 1/32" SHEET
A
A
5
6
7
8


CUT OUT FOR LANDING GEAR
REINFORCEMENT STRIP 1" sq. 16
RIB SECTIONS
1" sq. 8
TAPER SPAR FROM 1" SHEET TO SIZES OF RIB NOTCHES
INTERNAL HINGE DETAIL
ATTACH INDICATOR BENEATH LEFT WING
CIRCLE
BLACK PAPER
COVER THIS PORTION BOTH SIDES FROM EDGE TO EDGE WITH 1" SHEET 32
GRAIN
1" x 1" 8 4
TYPICAL CROSS SECTION
RIB 2
CUT OUT NOTCH
TUBE HINGE
RIBS 1&2 1" SHEET 16
OTHERS 1" 32
SPEED INDICATOR
CUT OUT
RIB 1
ALSO STUB RIB


FRONT VIEW 1/4 SCALE
DIH. 1 1/4"
1 1/8" x 1 3/4" x 9"
WIRE HINGE
WIRE LOCK
CONE FULL SIZE
TOP
BINDING
INNER STRUT DETAIL
FRONT
PROP HALF SCALE
HALF SCALE FRONT VIEW OF LANDING GEAR-BROKEN LINES DENOTE RETRACTED POSITION
PAPER HINGE SEE SIDE VIEW
AA
BB
CC
DD
TOP VIEW NOSE BLOCK
CUT OUT BOTTOM
SIDE OF MAIN CONE
LEAVE FLAT TO FIT FILLET
CUT OUT
CUT OUT


STABILIZER BRACE
HALF VIEW STABILIZER
ENCLOSURE FORMER
3/32" sq.
OUTLINE OF CONTROL
ALL EDGES 1/16" BAMBOO
ALL BULKHEADS 1/16" SHEET
1/16" sq.
RUDDER
3/32" sq.
BLACK PAPER
BLK. 6
BLK. 5
BLK. 8
BLK. 7



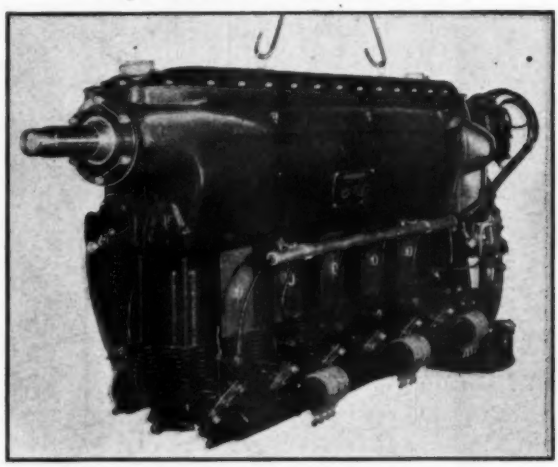
The experimental Northrop Attack plane, the forerunner of the new Army Attack planes

# Frontiers of Aviation

## Intimate Facts Concerning the Latest Planes and Their Manufacture—Building a Scale Douglas "Sleeper"

By ROBERT C. MORRISON

FOR the past two years these articles have appeared in MODEL AIRPLANE NEWS bringing you first-hand details of the latest domestic and foreign airplanes. In reviewing the planes described in these pages we have seen ships of all types and sizes from the diminutive Aeronca to the Giant Martin "Clipper" planes. Curtiss, Northrop, Lockheed and all others have produced new and striking designs in almost unending numbers. Speeds have been enormously increased and there is talk of still higher speeds in the near future. But none of these planes have held the spotlight for any great length of time with the probable exception of the Douglas DC-2, and it is unlikely that many more of them will be built since the birth of the Douglas DC-3 (DST). Even the gigantic Martin and Sikorsky "Clippers" will lose their reign as super-flying boats on the completion of the proposed Martins and Sikorskys that will be two and three times as large. Aviation is still a fast growing industry, and it will be for some time before it has matured—before the various types of aircraft retain certain size limits.

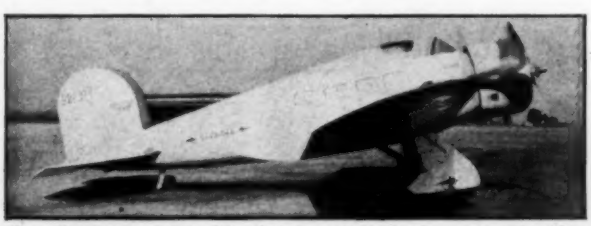


The Menasco "Buccaneer" (B6S) 200 hp. engine

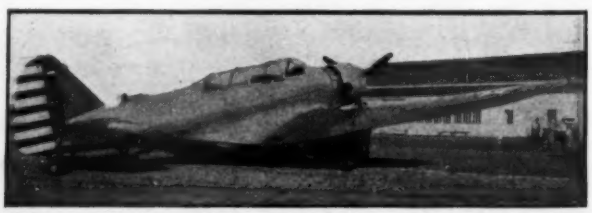
There are still great aircraft developments to take place. The employing of the mass production method in the building of aircraft is still some distance away. Not until then will the industry reach a normal level where it will develop slowly and steadily and not like a fast growing child as it has done in the past two years, and fortunately may do so for several years to come. The cost of new equipment for mass production is too great to allow a company to make striking changes in design year after year. It should be a gradual change with added improvements each year as in the automobile industry, but the aircraft industry is developing too fast for that at present. Besides the great expense, this is one of the major reasons why no aircraft company is now manufacturing planes by mass production. Too great are the obvious improvements that may be made in aircraft design in the next few years. So many engine companies are talking about producing 2,000 hp. engines soon that it is only a question of time before future airplanes will put our present ships to shame. Instead of strewing four engines of 800 hp. each along the wing of a Martin "Clipper" only two of the 2,000 hp. type will be needed and even then there will be an excess of power! The detail involved in our larger airplanes makes it almost impossible to produce them at present by mass production. More simplicity in design must be obtained, and this cannot result until aircraft has reached the end of its present seemingly miraculous fast growth.

The Douglas Aircraft Co., Inc. is representative of one of our leading and most prosperous aircraft companies. The huge plant at Santa Monica, Calif., adjoining Clover Field, is soon to be doubled in size. Already one large extension is about completed.

On entering the plant, one is confronted by a locked gate, and not until he has convinced company officials that he will not disclose secret details of new Douglas military aircraft may he pass into the plant proper. Once inside there is plenty to see. At the westerly end of the long narrow building is what might be called the heart of the factory. Here is probably where the company at present holds its future in stake. This is where all dies are made for drop hammers and presses. It is mostly

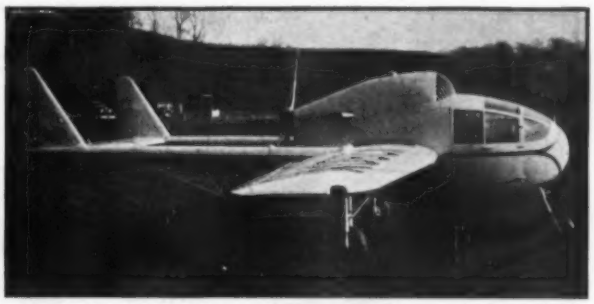


Roy Hunt's special Lockheed Orion 9D-1 Bendix racer "Sheridan 72½, with 550 hp. Wasp (McLarren)



The new Northrop F-2 U.S. Army Fighter with an 830 hp. twin Wasp engine (McLarren)

How the British intend to lift a heavily loaded plane into flight by a "Mother" plane. The planes are being built now



One of the latest light two-place sport planes, the Campbell, powered with a Ford V-8 engine

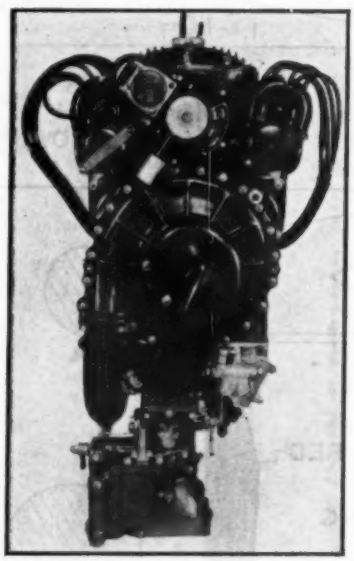
here that it is determined whether mass production is possible for the drop hammer is the only method so far devised that will make intricate sheet metal forms accurately and at low cost.

The Vultee concern, though a small company, has probably made the most progress along these lines and has done most in bringing such mechanical equipment as the drop hammer into the aircraft industry. They have designed several of the drop hammers now used at Douglas. They cost about $1500 each to construct.

The drop hammer is a very simple machine. Its hammer head slides in guides and is lifted by a rope coiled several times around a revolving drum. The hammer head with die attached is raised and then dropped quickly onto the base where is also a die covered by a sheet of aluminum. The sheet metal is thus stamped out into a definite shape in a few seconds, where it would have taken a man many hours to hammer the same part into shape by hand. The dies are usually cast of zinc and have 100% salvage value. When the die has been used as much as is needed, it may be melted and recast.

The drop hammer is used for making such parts as wing fillets, windshield panels, dashboard panels, etc., and larger parts are usually formed by giant hydraulic presses especially adopted for working aluminum as aluminum tends to spring when pressed, while if given the hammer effect obtained by the drop hammer method, it keeps its desired shape. Douglas has a huge press reaching to the ceiling and 8 to 10 feet square and also several drop hammers in operation constantly.

Walking down the building one may see on both sides all sorts of welding and cutting apparatus, machines for corrugating and rolling sheet aluminum, and all sorts of jigs and dies too numerous to mention here. Further on we come to where the enormous wings are being assembled in vertical jigs and even further may be seen the many fuselages taking a definite shape. Giant complicated jigs are set up in rows to hold the thousands of aluminum parts put into each fuselage. Among these are several DC-2s for the Army and off to one side can be seen a few of the DC-3s taking shape. The fuselages of these are so large that a small scaffold has to be built around to hold the workmen. In the center of the plant where the final assembly takes place



Supercharger on the "Buccaneer"

may be seen the first of the DC-3s waiting to be delivered to American Airlines. Also here may be seen several military versions that are ready for testing or have completed tests. A large part of the plant is devoted to military work where much is in progress at the present time. Since the introduction of all-metal construction at Douglas, the doping, fabric and woodwork departments play a very small part and little activity is found here. However Douglas planes with wooden wings and fabric covering are still being made, mostly of the observation type and some possibly for export.

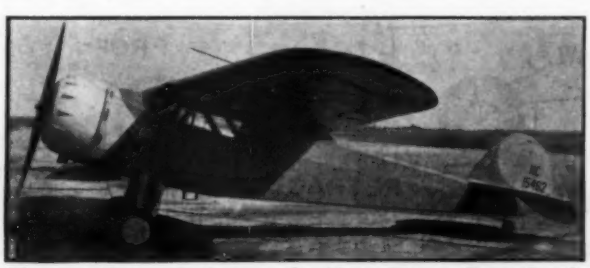
On the second and only other floor of the plant is the huge drafting room filled with engineers designing new planes. Also on this floor is manufactured the various smaller parts that goes into the airplane. All in all, in glancing over the activities at the Douglas factory much has been accomplished in the past few years in the way of manufacturing methods. However there are still great improvements to be made, and it will undoubtedly be Douglas who will be the first to make them.

The concern is devoting all its time to the building of the larger type aircraft and has not evidenced intentions of manufacturing a small sport plane. However this is just the company that should undertake such an enterprise. It is a large company such as Douglas that would be able to manufacture a small sport plane in large quantities and not the small lesser financed company that has been striving in the past to produce such planes. Douglas has the equipment and is apparently financed well enough to produce a small plane for the public, and it would be a great boom to American aviation if Douglas were to undertake such a development.

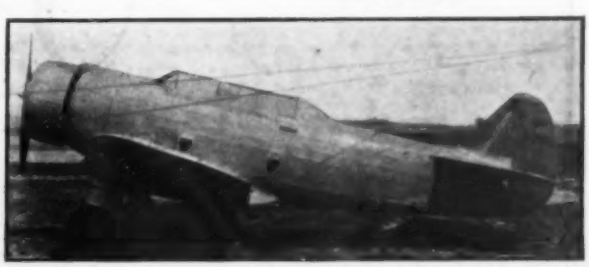
Among Douglas' most recent achievements is the winning of the much publicized bomber competition at Dayton! The Army has ordered 90 Douglas swift, midwing bombers at a price of $6,498,000! The plane will be powered by two Cyclone engines. Boeing also received an order for 13 of their four-engined Pratt & Whitney powered bombers. The Douglas bomber was the first to arrive at Dayton for the competition and for several weeks it underwent tests with little notice. Not until the Boeing made headlines was there much interest aroused in the competition which consequently brought the Douglas into the limelight.

Construction has now started on a new 45-passenger Douglas transport known as the DC-4. It will be double the size of

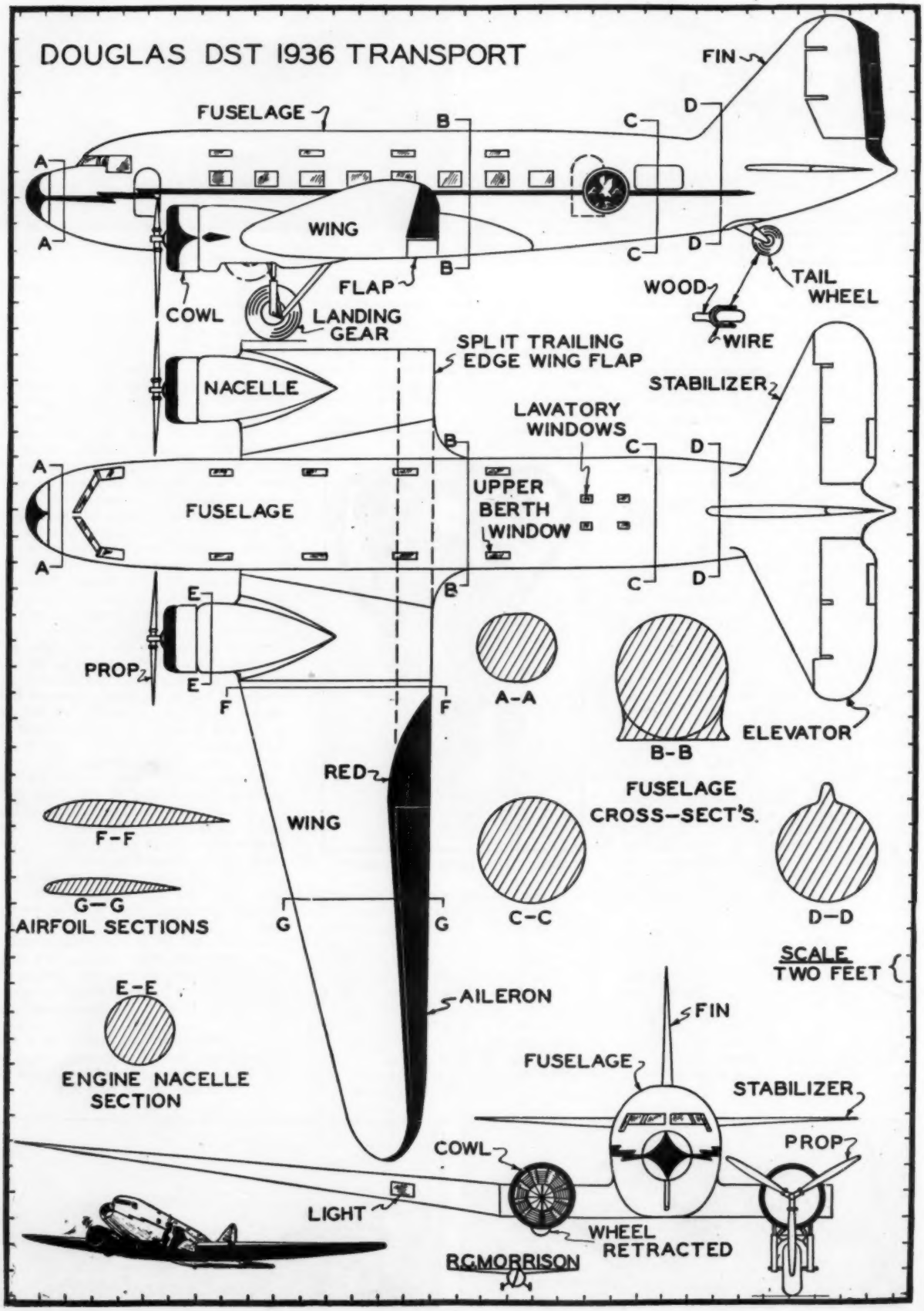
*(Continued on page 39)*



The new Cessna C-34 powered with a Warner Super Scarab 710-A 145 hp. engine (ATC-573) (Kelman Photo)

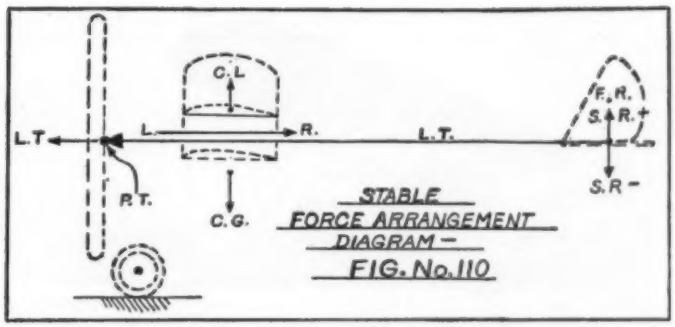


The North American NA-16 basic trainer of the U.S. Army Air Corps. A fast sturdy plane


DOUGLAS DST 1936 TRANSPORT
FIN
FUSELAGE
WING
FLAP
COWL
LANDING GEAR
WOOD
TAIL WHEEL
WIRE
SPLIT TRAILING EDGE WING FLAP
NACELLE
STABILIZER
LAVATORY WINDOWS
UPPER BERTH WINDOW
FUSELAGE
PROP
A-A
B-B
ELEVATOR
RED
WING
FUSELAGE CROSS-SECT'S.
F-F
G-G AIRFOIL SECTIONS
C-C
D-D
SCALE TWO FEET
E-E
ENGINE NACELLE SECTION
AILERON
FIN
FUSELAGE
STABILIZER
COWL
PROP
LIGHT
WHEEL RETRACTED
R.G.MORRISON

# Choosing a Model Type for Stability

## How to Select the Type of Model That Will Conform to a Stable Force Arrangement




By CHARLES HAMPSON GRANT

Chapter No. 5—Article No. 49

PERHAPS you have read the two preceding articles (No. 47 and No. 48) of this chapter, which tells you something of the procedure of designing your model plane. If you have not, it is suggested that you read them carefully in order to secure the sequence of the procedure and explanation of the analysis that leads up to the discussion presented in this article.

It has been shown how the forces acting on an airplane in flight should be arranged to produce stability to a *high degree*. Insomuch as the arrangement of the structural parts of the model determine the type of model, as well as the disposition of the flight forces, it is evident that one particular type will be best from a standpoint of stability. This type will be the one which most readily produces the arrangement of forces established as the most stable one. In our last article various types of models were enumerated and described. Now it is required that each one of these be considered as a possible choice.

In order that it may be fully understood what qualifications are required and what type of model fulfills them to the highest degree, simple rules for force arrangement are summarized as follows:

1. The center of gravity should be as far *below the center of lift* as possible. If it cannot be made to coincide with the center of lateral area then it should be below it only slightly, never above it.

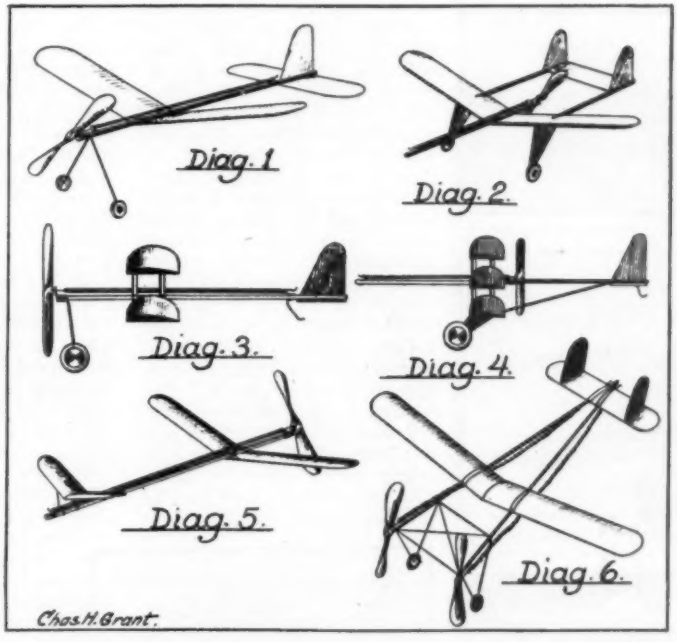
2. The line of thrust should coincide with or be slightly below the line of resistance.

3. The line of thrust and consequently the line of resistance should be *above* the center of gravity.

4. The tail moment arm should be as long as possible, not less than ⅔ the span of the wing.

5. The stabilizer area should be large, about ⅓ the wing area, unless other factors can be used that will allow less area (such as a wing section, the center of pressure of which remains stationary, or a biplane or triplane arrangement).

6. The fin area should be large; usually about ten to twelve per cent of the wing area (6½% to 7½% on gas models). The fin area should be in proportion to the dihedral on any model.




7. The nose or distance from the center of gravity to the extreme nose of the plane should be as short as possible.

8. The weights of the structure should be as close as possible.

9. The wings should have large dihedral.

Now let us consider each model type in the light of these general rules and the stable arrangement of forces that has been established in the first part of this chapter, Fig. No. 110. In order to determine the type of model to be used to fulfill our purpose, it becomes a matter of checking the models of various types against the force set up that will produce stability. Then the best type must be chosen.

How does the single propeller tractor monoplane shown in diagram No. 1 measure up to these qualifications? Can the model be built in this form with a low Center of Gravity? The C.G. of the whole structure not including the landing gear is *very* slightly above the rubber motor or line of thrust, if the wings have a normal amount of dihedral (one inch per foot of span). In this case however, a large amount of dihedral should be used in order to insure a high degree of lateral stability for the model: two inches per foot of span is not too much. This will raise the C.G. slightly but the C.L. to a greater extent, for as the center of lift is slightly below the midpoint of a line connecting the points of center of area of each wing half, the C.L. will be *higher* when the wings are raised from a normal dihedral angle to a larger one. The center of lift will then be well above the line of thrust, as shown in Fig. No. 110. This places the C.G. well below the C.L. also, which is desirable.

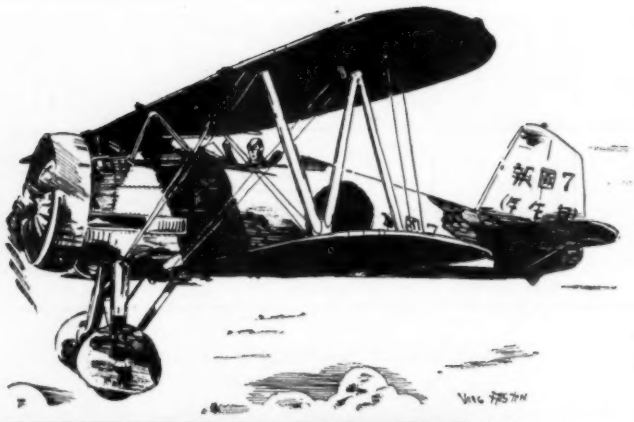
Thus the center of lift can be established at the point shown in the figure, by the use of a wing of large dihedral with its center section just below the motor stick, as indicated by the dotted lines in the figure. However, a high wing with its center section above the rubber motor may be used also without changing the C.L. from the position shown if little dihedral is used, say ¾ inch per foot of span. This will be obvious with a little consideration.

So far we have been considering the plane without a landing gear. Now if a heavy landing gear is added, the C.G. will be lowered from a point just above the rubber motor to a point well below the stick, as shown in the figure. In this way the *C.G.* can be established well below the C.L. by using the type of plane given in Diag. No. 1. It is evident that

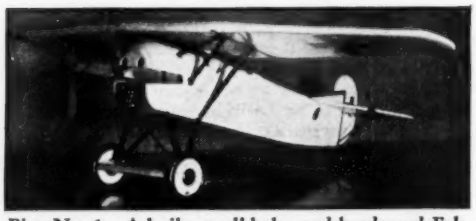
*(Continued on page 34)*

# AIR WAYS
## HERE AND THERE

**What Readers Are Doing to Increase Their Knowledge of Aviation in All Parts of the World. Send Pictures and Details of Your Experiments**



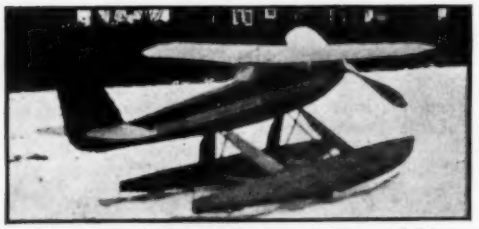
The Nakajima Fighter by V. Alston



Pict. No. 1. A built-up all-balsa and hardwood Fokker D-8 by Joe Jackson

Pict. No. 2. Bob Tulga's compressed air job

Pict. No. 3. A trim solid scale DH-5 with all external details, by E. Tomkiewicz



Pict. No. 6. D. Kallmann's clever amphibian

MANY model builders are probably wondering, having read the March issue, how they can join the Air Ways Club. Unfortunately, the coupon was omitted in the last issue, which made it inconvenient to send in your application. If any builders are interested, fill in the coupon appearing at the end of Air Ways or write to us, giving your name, address and how long you have been building models. Mail your letter to Air Ways Club, MODEL AIRPLANE NEWS, 551 Fifth Avenue, New York City. This club will be sponsored by MODEL AIRPLANE NEWS and news of the club will be furnished each month. Data on the formation of units, outlines for instruction in model building and for creating interest within the organization of any particular unit, will be available to club members shortly. The object of the club is to promote aviation, especially of the model variety, and to help our club members to acquire a complete knowledge of aviation matters. Club members may look forward to club contests with a national contest held each year. Rules governing flights under the Model Club's sponsorship will soon be available. If any model fans have any ideas as to what they feel these rules should include and how the club should be conducted, write in to the Air Ways Club. We wish this organization to be "the" model builders' club, one which will be helpful to every member and to which anyone would be proud to belong.

One point of interest concerning the club is that there are no dues. All that is required of you in order to make you eligible is that you have built a model plane. Get busy and help to swell the Air Ways Club membership.

An unusual drawing of the Nakajima "90" has been sent in by Virgil Alston of R.R. No. 2, Oxford, Ohio, which serves as the decoration for our Air Ways this month. This is the first picture of a Japanese plane that has been sent to us. Unquestionably the airplane designers of the "land of the rising sun" are making great strides in aviation. In the last few years many improvements in design and construction have appeared in their aircraft. Mr. Alston's contribution is appreciated.

Mr. Joe W. Jackson of 315 East Hickory Street, Neosho, Missouri, makes an unusual contribution. He sends us picture No. 1, showing his Fokker D-8, which, he says:

"Cannot be classed as a flying model or a solid wood model. It has a flying model framework throughout the fuselage and wing, but the material used is 1/8" square balsa for the fuselage and wing spars with 1/16" solid balsa wing ribs spaced an inch apart throughout the wings. The wing and landing gear struts, wheels and propellers are all made from solid pine."

This is a very novel way to build a scale model. Possibly with sufficient power applied to it, it might fly. Mr. Jackson says that he had unusually fine results in finishing this model by using Cooks' Rapidry Enamel, which gave it a very brilliant glossy finish. Here is an idea for some other builders.

Picture No. 2 shows a compressed air model built and flown by Bob Tulga of 413 Wilson Avenue, Columbus, Ohio. He says that the motor of this job is a special one that he made himself. He was able to do this because he works in a machine shop. A feature of the motor lies in the fact that the bottom of the cylinder is sealed except for a small opening where the crankshaft passes through. This allows an air cushion below the piston which contributes to the smooth operation of the motor. The tank is three and a half inches in diameter and thirty-three inches long. It is made of a lightweight aluminum alloy metal. Tulga has put a pressure of 325 pounds into this tank.

Pict. No. 8. A real flight by Chas. Kennett's "Fleet"

Pict. No. 7. Henry Clark stands beside his scale model. (Don't let this fool you)

He says:

"I tested it with a meter, using a fourteen inch prop and turning 1500 r.p.m., and it kept up this speed for seven minutes, thirty-five seconds before dropping below 1500 r.p.m."

This is very unusual. Tulga also says that this job flies with perfect stability even though it has no dihedral in the wings. There is, however, a dihedral in the stabilizer, which he claims provides the necessary stability. Each half of the stabilizer is turned up fifteen degrees. This is a very unusual arrangement and should provide food for many experiments among model builders. It is difficult, however, to imagine that this ship is as stable as if the dihedral was in the wing.

We wonder what happens when the ship falls off to the side while climbing or why it does not dive on a turn. The tail surfaces are pretty small. Possibly this contributes to spiral stability; for the less the dihedral in the wing, the smaller the fin area should be made. This, however, often gives the ship spinning characteristics. If Tulga could submit pictures of this ship in flight, they will be appreciated by our readers.

The solid scale of the DH-5 shown in picture No. 3 was submitted to us by Ervin Tomkiewicz of 5406 Dakin Street, Chicago, Illinois. It is one of the finest-looking solid scale models submitted recently, as well as being a ship which you do not see very often. It is complete with all external details; such as, correct insignia, pitot tube, landing lights, flying wires, etc.

Frank M. Kennedy of 30 Gilbert Street, North Brookfield, Mass., sends us picture No. 4. This is a very unusually posed photograph. One would certainly think that it was a big ship snapped in flight while it was "passing over." It is actually a scale model of a Boeing P26-A. The ship was strung on wires between two trees. It seems that solid scale model builders are taking up tree climbing as well as flying scale builders. Those who have engaged in this pastime know that it is a favorite sport peculiar to model airplane fans.

One of the best pictures of a model flight has been sent to us by Donald McLeod of 932 Ingersoll Street, Winnipeg, Man., Canada. His model, a Cessna, is shown taking off in picture No. 5. This is a flying scale job which has been very carefully made. Its official time is six minutes, at which time it flew out of sight and was never found. This is the longest flight of a flying scale model of which we have a record.

McLeod belongs to the Model Aircraft League of Manitoba, of which he is secretary and treasurer. This is a parent body of many smaller clubs.

McLeod wonders how Leo Weiss' gas job can travel an estimated speed of sixty miles per hour, considering the fact that he is using a Brown engine with a propeller of eight inch pitch. He says:

"Unless my figuring is wrong, his plane could not go any faster than 45.45 m.p.h. with his prop 100% efficient. If the prop is 75% efficient, then it would be only 34.09 m.p.h.; and all this at 6000 r.p.m."

Have any of our readers got any ideas about this? It looks as if Mr. McLeod is right.

He also tells us that he has made an indoor flight with a semi-scale model of two minutes, twenty-seven seconds. Canadian fans seem to be stepping up in their model building.

We have an unusual composite model shown in picture No. 6. It was submitted by David Kallmann of 42 West Hill Avenue, Springdale, Conn. He says:

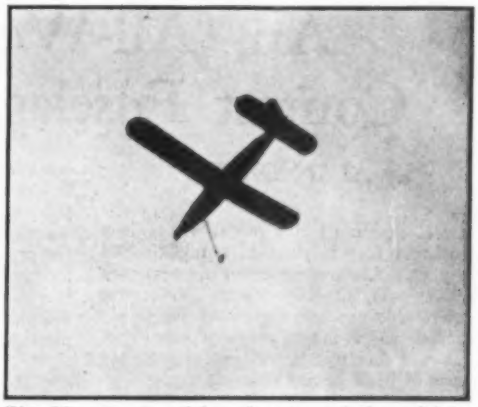
"This plane is a combination of a racing outdoor event model with the pontoons from the plans of the model Macchi Castoldi seaplane. The skis were easily assembled to the landing gears and the retractable wheels are an added feature."

This is Kallmann's twenty-fourth model.

Our trick photographers are busy again. This seems to be a popular winter pastime. Henry Clark of 46 Fort Washington Avenue, New York City, is the one who is responsible this time. He has sent us picture No. 7, which shows one of his scale models, beside which he is standing. The picture was made by Clark, who cut out a small picture of himself and pasted it on

*(Continued on page 28)*

**Pict. No. 5. Donald McLeod starts his D scale Cessna on its official flight of 6 min.**



**Pict. No. 12. A weight rule 200 sq. inch model in full flight, by W. Mackley, New Zealand**

**Pict. No. 4. Not a real ship passing over, but only a P26-A posed by F. N. Kennedy**

**Pict. No. 9. L. Cline's flying Russian Fighter**

**Pict. No. 13. A beautiful Martin Y-10. It took Herb. Kelley 600 hours to build it**

**Pict. No. 14. A clever NC-4 by H. Westhoff**

**Pict. No. 11. Two snowbirds of the Lockheed genus by L. S. Wigdor**

**Pict. No. 10. H. Minowa and K. Katoke of Tokyo give the air to a twin motor "93" bomber**

# An "All-Weather" Contest Fuselage Model

By ALAN ORTHOF

THE design of this model makes it a consistent flier in practically any kind of weather. An average flight time of two minutes can be easily obtained with it in unfavorable weather, and from five to six minutes under more favorable conditions. You will find that it will give a good account of itself in any contest.

### Fuselage

The fuselage is of simple square construction, being constructed entirely of ⅛ square balsa.

Pin the ⅛ square balsa longerons onto the side view of the fuselage. Add the cross braces and allow time for the cement to dry before removing the pins. Make two sides.

Join the two sides together by cementing the cross braces in place as shown in the top view.

Add the rear hook, which is made of No. 040 piano wire. The fuselage is now complete with the exception of the covering.

### Landing Gear

The landing gear is made from one piece of No. 040 piano wire. This completely encircles the second section of the fuselage. Medium 1/16 sheet is cemented to each leg for stiffness. Attach the wheels to the axle and leave a distance of 8 inches between them.

The author with the finished model just before it flew out of sight

### Wing

The airfoil section is the R.A.F. 32. In order to obtain the correct rib sizes, scale up the pattern on the plan.

The wing is constructed in one piece, re-

*(Continued on page 44)*

Its speed will surprise you

# Building a Midget Racer

## An All Balsa High Speed Racer That Will Please the Novice or Expert

By AUGUST RUGGERI

IN THE February issue of MODEL AIRPLANE NEWS you were shown how to build a two in one stunter. If you remember, although that model flew very fast it flew in circles. Here you are shown how to change it into a straight flying speedster.

You won't be able to fly this speedster in your living room like the stunt plane, but now that spring is just around the corner you can fly it out of doors.

This is what you do to change your stunt model into the little speedster.

The changes are simple enough. The fuselage is made longer, the propeller larger, the wing is moved back a little and more power is used. In size, the wing remains the same but it is made of thicker wood. Also, the landing gear is made of stronger wire (.028" diam.) and it is made ½" longer than as shown on page 23 of the February issue of MODEL AIRPLANE NEWS.

At the end of this article you will find a complete list of the materials needed which should be purchased from a reliable model airplane dealer. Proceed as follows:

### Construction:

Start with the wing. By doing so with this kind of model you will find that you can save time. When building a cabin model which has a built-up fuselage you would then start with the fuselage.

Cut two pieces 5" long from the 3/32" sheet balsa, round off one end of each piece as you did when you built the first model of this series and sandpaper each until a rib section is formed. You should finish with very smooth sandpaper such as 8/0 or 10/0. You might go further—polish the surfaces with the famous glider polish. Again like the wing of the first model, the two halves are cemented in the center and the same dihedral is used; namely, 1¾".

The little plane will fly in a straight line at high speed. Build and try it

The most important change in the model is the length of the fuselage which is made 10 inches instead of 7. Cut it from ⅛" hard balsa and sandpaper it to the shape shown in the plans.

The tail surfaces are made from 1/16" medium soft balsa sanded till it is 1/20" thick. Then they are polished.

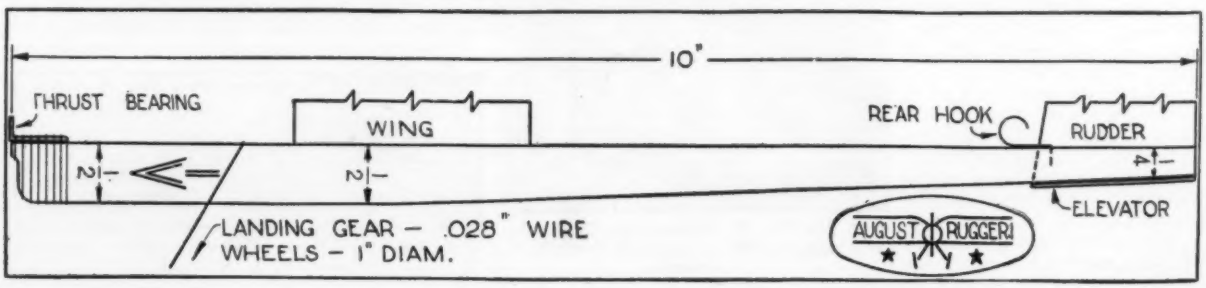
To propel the model the use of a machine cut propeller 5" in diameter is advisable. Sandpaper ⅛" from each tip and sandpaper the rest of the propeller until it is smooth. If you want to make the propeller use a block ⅜ x ¾ x 4¾ inches.

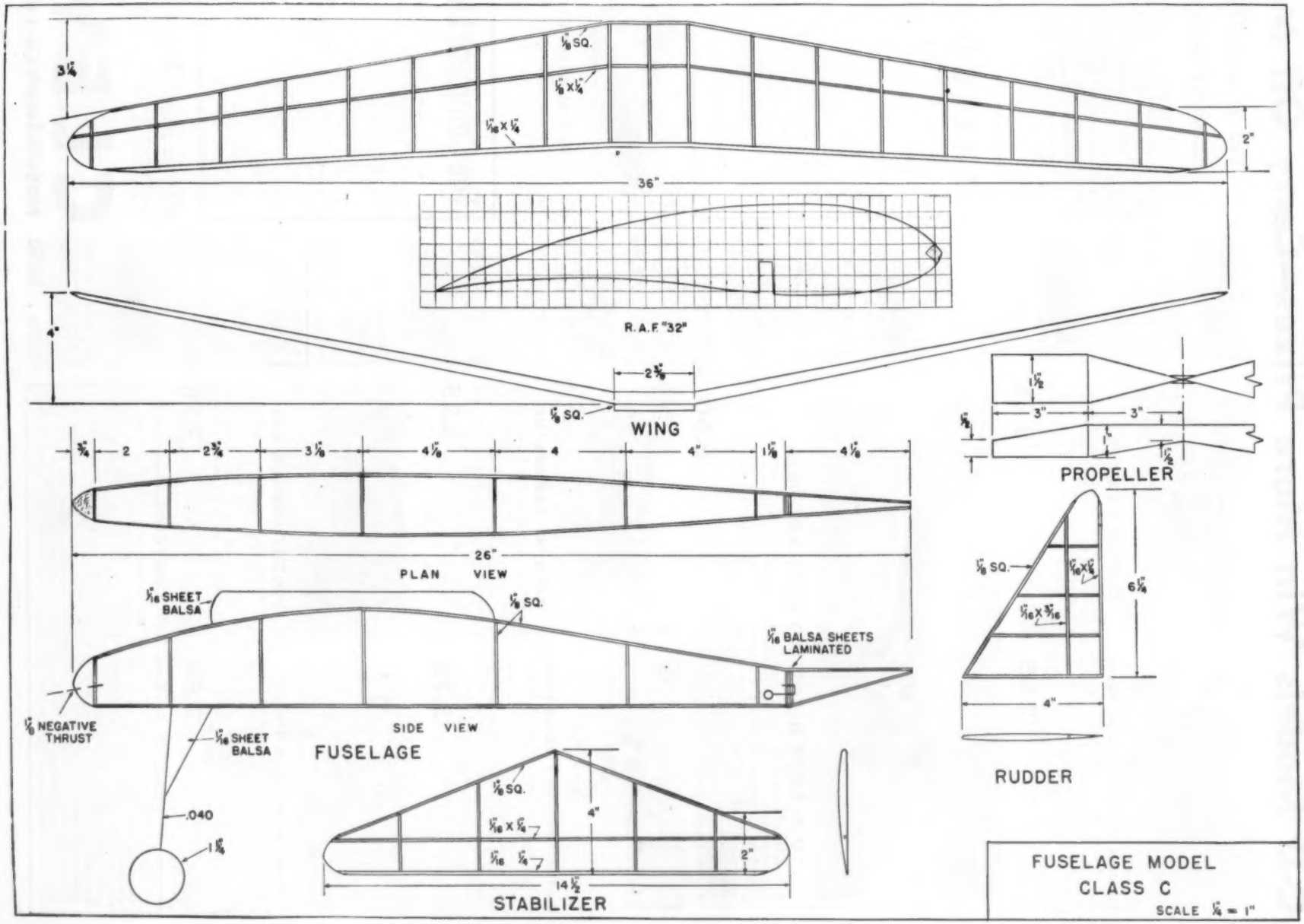
An oversupply of cement rather than too little should be used to assemble the parts. It is better to make a model too strong than too weak. When the cement dries the model is ready for flight. The following may prove to be very helpful hints. Use them when testing the finished plane.

### Directions for Testing:

Wind the propeller about 10 times (in

*(Continued on page 43)*




3¼"
1/8 SQ.
1/8" x 1/4"
1/16" x 1/4"
2"
36"
R.A.F. "32"
4"
2 3/8"
1/8 SQ.
WING
3/4
2
2 3/4"
3 1/8"
4 1/8"
4
4"
1 1/8"
4 1/8"
26"
PLAN VIEW
1/16 SHEET BALSA
1/8 SQ.
1/16 BALSA SHEETS LAMINATED
1/8" NEGATIVE THRUST
1/16 SHEET BALSA
.040
1 1/4
SIDE VIEW
FUSELAGE
1/8 SQ.
1/16 x 1/4
1/16 1/4
4"
2"
14 1/2"
STABILIZER
1 1/2"
3"
3"
1/2
1"
1/2
PROPELLER
1/8 SQ.
1/16 x 1/2
1/16 x 3/16
6 1/4"
4"
RUDDER
FUSELAGE MODEL
CLASS C
SCALE 1/2 = 1"

# C-D Models Win More Prizes—Carry Off Mor

### Turner's Wedell Williams Racer

Capt. Roscoe Turner with this ship won the '33 Bendix race and '34 Thompson race. Plane holds record for crossing the U. S. both ways. Forced out of first place in '35 Thompson race due to broken oil line. Span 19½". Wendell-Williams gold. Kit SF-48 ..... $2.95

### CURTISS HAWK P6-E

Colored like Hawks in 17th Pursuit group, yellow, olive drab, black and white. Our redesigned model is the most advanced type to be found anywhere. Many details. Often built by the best model builders when "first prize" is sought like our SF-49. Fast flights. Span 23⅝". Kit SF-21 ..... $3.25

### HEATH PARASOL

Span 23¼", length 12¾", weight 0.8 oz. Mostly orange, decorative black fuselage side panel. Excellent for beginners, and a "duration" flyer. Kit SF-26 ..... 98c

### BOEING 95 MAIL

Easy for beginners. Redesigned for beauty and even greater duration than ever before. Span 33½", length 24½", weight 3.5 oz. Blue and silver. Kit SF-32 ..... $2.50

### U. S. ARMY HIGHSPEED MARTIN BOMBER

Claimed fastest service bomber in world. Span 53", length 33¼", weight 17 oz. Colored standard U. S. Army yellow, olive drab, details black. Novel and strong method of duplicating an almost impossible landing gear (but not retractable). Complicated fillets beautifully (and easily) duplicated. Nothing ever before like it—even our Boeing 247. Turned Balsa invisible hub wheels. By simply removing motor spars (the only time-proven efficient methods of multi-motor powering) model is ready for exhibition. If sold 5 or more years ago, would easily command at least $20.00, Complete printed-out-wood (Giant) Kit SF-45, postfree ..... $8.50

### BAYLE'S GEE-BEE

1931 Air Race sensation. Span 17⅝", length 12", weight 2.1 oz. Yellow and black. Kit SF-17 ..... $1.95

### SUPERMARINE S6.B

Greatly improved model of this Schneider Trophy winner, which will R.O.W. Span 22¾", length overall 21⅝", weight 3.2 oz. Silver and blue. Kit SF-19 ..... $2.50

### Curtiss (Goshawk) F11C-2 Fighter

High speed U. S. Navy shipboard fighter. We claim our Hawks (21, 49 and 50) the most accurate and finest to be found anywhere at any cost. Designed for advanced model builders who want a thoroughly detailed scale model and one which, when completed, represents the acme of perfection in model building. Span 23⅝". Silver, yellow, gray and green. Kit SF-49 ..... $3.75

### WACO "C" CABINPLANE

The most popular fast cabin biplane in the world. Used by many sportsman pilots and business men. This model was designed for advanced model builders. It is a very good flier, is neat in appearance, and not too hard to construct. Span 24¾". Colored silver and red. Kit SF-37 ..... $3.25

### HAWKER HIGHSPEED FURY FIGHTER

Span 22¼", length 19½". Redesigned. Long fast flights. All silver with light blue markings Kit SF-20 ..... $2.65

### Great Lakes Sport Trainer

This beauty is probably the best liked and most maneuverable 90 H.P. plane in its class. An attraction wherever displayed with its interesting swept-back wings similar to modern dive bombers. Model has good flying qualities, span 20", colored orange and cream. Kit SF-1 ..... $2.65

### VOUGHT CORSAIR V-65

Used by U. S. Navy as two place shipboard fighter, dive bomber and executive transport, this Cyclone powered plane is fast and maneuverable. It is very completely detailed and intended for advanced model builders. Span 26⅞". Colored blue, yellow, red, black and silver. Kit SF-41 ..... $3.75

### LINCOLN SPORT

A lightplane sensation. Beginner's model. Span 15", length 12¼", weight 1 oz. Cream, black trim. Kit SF-36 ..... 98c

**Build this ¾" C-D line of Thompson Trophy Winners**

| | |
|---|---|
| '29 SF-2 | $2.95 |
| '30 SF-46 | 2.50 |
| '31 SF-17 | 1.95 |
| '32 SF-27 | 2.50 |
| '33 SF-47 | 2.95 |
| '34 SF-48 | 2.95 |

Complete Set $15.80

¾ scale Mr. Mulligan to follow soon.

### A-W QUAD FIGHTER

Very unusual steady wartime flyer. Easy to build. Span 20⅝", length 18¾", weight 2.3 oz. Red, white and blue. Kit SF-11 ..... $2.50

## EVERY ¾" C-D KIT CONTAINS

1. Full size assembly drawing. 2. Blocks and coloring for pilots. 3. Coloring for propellers, whether metal or wood. 4. Black for all details. 5. Thread for all bracewires (mostly new silver grey). 6. Printed out wood, not a few places rubber stamped, but every necessary curved piece printed out clearly on the finest grade of balsa wood obtainable. 7. All strip wood necessary. 8. Sufficient dope for the model, cement for glueing it together and tissue cement for applying the paper and coating. 9. Complete material for scale propeller as well as that for flying propeller. 10. Authentic rib and stringer material supplied now in all Kits (many filled-in fuselage jobs, too). 11. And, of course, all necessary insignia, color for striping with tape, special new shaped wood blocks, etc., where needed.

*Yet it usually co ss*

*beautiful authentic atur*

Did we say "it usually costs less to C-D's" figures out. Listen! When one consi mist ordinary models, how disappointing then much additional material is often ne comp that a modelbuilder is money ahead, e ah real modelbuilders' Kits—designed, ured themselves modelbuilders, and there w buying models. So make up YOU now ning models—that perform so beauti "lo play. That's the surest way you e the f building. *And 1936 is going to be a r f*

## THE COPYC

*Wherein Copycats Ac ledg*

**Did You Notice These "Imitation eature**

Continuing from last month's advertisem & We we give you more reasons why Clevela ds and leads the model Aircraft field: re imit

4. In 1931 we originated the use of pi eller heads in flying models. The first time ne nev our F1 100 line, flat cut-out heads of pap e bla were employed, now widely duplicated. N in th in all ½" and ¾" scale model Kits, we su had ply blocks and complete drawings and ow structions for carving them.

5. Have you noticed a cheaply reprodu re to Fokker D-7 model colored after our e paid adaption of an interesting color scheme this D-7 war planes—another cheap imitation.

*"Imitation is the sincerest of fla*

### DOUGLAS O-38 OBSERVATION

Very beautiful and unusually well detailed model. Authentic only as "Cleveland" makes 'em! Span 30", length 22⅝", weight 4.8 oz. Yellow, olive drab, black details. 2 pilot blocks. Kit SF-43 ..... $3.75

## The Complete Line of D 1/2

★ ★ ★ *The Big Sensation of Model*

These are precisely like the ¾" models length of "Dwarfs" take ⅔ the length we recommend the same colors as used DWARF Kits DO NOT CONTAIN LIQU STR

*Packing Charge Has Been Discon Pric*

| No. | Name | Span | Price |
|---|---|---|---|
| D- 1 | Gr. L. Sport. Trainer | 13 3/8 | $ .65 |
| D- 2 | Tr. Air. Mystery Ship | 14 1/2 | .50 |
| D- 8 | Army Boeing P12-E | 15 | .65 |
| D-11 | A-W Quad Fighter | 14 | .45 |
| D-14 | Fokker Triplane | 11 3/4 | .45 |
| D-15 | Fokker D-7 Fighter | 14 1/8 | .60 |
| D-17 | Bayle's '31 Gee-Bee | 11 3/8 | .50 |
| D-18 | Howard "Pete" Racer | 10 | .30 |
| D-19 | Supermarine S.6B | 15 | .65 |
| D-20 | Hawker Fury Fighter | 15 | .45 |

| No. | Name | Span | Price |
|---|---|---|---|
| D-31 | Hawk P6- | 15 | .5 |
| D-33 | Boeing F | 14 | 1/ |
| D-34 | Lockheed | 30 | 1/ |
| D-36 | Heath Pa | 15 | 1/ |
| D-37 | Dornbla | 13 | 1/ |
| D-38 | Monocoup | 16 | |
| D-39 | Boeing P | 15 | |
| D-32 | Boeing M | 30 | 1/ |
| D-33 | Cam | 19 | |
| D-35 | Boeing 3 | 26 | 7/ |
| D-36 | Lincoln S | 30 | |

"My brother bought one of your new Dwarf Dou Observa Cleveland's. They are swell. He has also built the P12-E Hawker Fury. They are all great! Cleveland Model win in

*Please Read Before Ordering*

Please mention your dealer's name and addre anada, all other countries, 20%. *Send 3c for complete catalog*

# CLEVE

**Model & Supply Co., Inc., 186 W. 5**

# ...onors—than Any Other Models in the World

*...s to build these ...tures of big planes*

...ess to ...C-D's"? Well, that's just the way it ...e consi... mistakes so easily made in building ...nting ... them are when completed, and how ...en ne... complete the model—it's easy to see ...ahead, ...e ahead, building C-D's. C-D's are ...ned, ...ured and marketed by men who are ...there ...ow what they'd want if they were ...YOU... now to build these real prize win-...beauti... "look like a million" when on dis-...you c... the fullest enjoyment out of model-...be a ...er for C-D builders!

## ...YCT COLUMN

*...Acknledge C-D Superiority*

**...ation...eatures Originated by Cleveland?**

...isement. We originated the slotted and drilled ...levela...ls and spinners for fibre propeller blades ...r imitated widely by others. While fibre ...of pi...opeller blades were used by others, they ...time ...en never used precisely as we produced flat ...f pa...e blades in halves with tabs. The condi-...d. No... in the model field has now gotten to be ...we s...ad that everyone, instead of making ...and ...r own blade designs, even follows our ...t outline; one concern even had the ...produc...ve to have cut propellers from dies which ...r ... paid for. Result, we stopped purchasing ...me f...m this source of supply.

(To be continued)

*...est ...of flattery." Ben. Franklin.*

**U. S. NAVY BOEING F4B3 (or 4)**

Beautiful flying miniature of the masterful fighter now used by the Navy. Exciting to build—thrilling to fly. Capable of fairly long flights. Span 22½", length 15⅝", weight 3.2 oz. Colored silver, yellow and red. Kit SF-29 **$2.85**

## ...D 1/2" (DWARF) Models

*...Model Airplane World* ★ ★ ★

...ilt here—with a few minor exceptions. For ...h ... corresponding ¾" model. For coloring—...ed ...' design. of the same model. Remember ...QU...r STRIPING TAPE; Otherwise Complete.

*...ntd. Prices Below Are All You Pay.*

| | | | | | |
|---|---|---|---|---|---|
| ...Fo... | ...15 1/4 | .75 | D-37 | Waco C Cabinplane | 16 1/2 | .75 |
| ...Fo... | ...14 1/8 | .65 | D-40 | Aeronca C-3 Sport | 18 | .60 |
| ...ed | ...10 1/2 | .85 | D-41 | Vought Corsair Fighter | 18 | .85 |
| ...Fo... | ...15 1/2 | .35 | D-42 | Howard "Ike" Racer | 10 1/8 | .25 |
| ...ker | ...13 1/8 | .50 | D-43 | Douglas O-38 Observation | 20 | .85 |
| ...oon | ...18 | .45 | D-45 | Martin Bomber | 35 3/8 | 2.50 |
| ...Fo... | ...15 | .65 | D-46 | Laird Solution Racer | 10 5/8 | .50 |
| ...Fo... | ...10 1/4 | .85 | D-47 | 33 Wedell's W. Wms. | 13 | .50 |
| ...ntal | 13 | .30 | D-48 | 34 Turner's W. Wms. | 13 | .50 |
| ...Fo... | ...10 7/8 | 2.50 | D-49 | Curtiss F11C-2 | 15 3/4 | .85 |
| ...ker | ...10 | .25 | | | | |

...t Observation planes. I never saw as complete a kit as ...ng P12-E and also the Aeronca C-3. I have built a ...t win in contests."—E.S.

...ding Try your dealer first. If he hasn't what you want, order direct, enclosing check or money order—cash at your own risk. No C.O.D.'s. ...nada, Mexico, British Isles customers—add 10%; ...talog-folder.

# ...LAND

...W. 57th St., Cleveland, Ohio

**TRAVEL AIR MYSTERY**

Completely redesigned. Span 22", length 13¾", weight 2.2 oz. Beautiful solid appearance. Red, black scalloping, green trim. Kit SF-2 **$2.95**

**GB SUPERSPORTSTER**

Doolittle's 1932 Thompson winner—and a beauty. Fast flights. Span 18½", length 13¾", weight 2.7 oz. White, red scalloping. Kit SF-27 **$2.50**

**LOCKHEED VEGA**

A picture for beauty—a wonder for flights. Span 30¾", length 21", weight 3.7 oz. Colored brilliant red & cream. Kit SF-24 **$3.25**

**COMPER SWIFT**

Redesigned. Excellent flights. Span 18", length 13⅞", weight 1.4 oz. Beautiful green, with black fuselage design. Kit SF-33 **$1.25**

**4-WHEELED HOWARD RACER "IKE"**

Span 15⅝", length 12⅜". Flies and climbs beautifully. Also data for "Mike." White, black details. Kit SF-42 **98c**

**FOKKER TRIPLANE**

Plane of Germany's greatest ace, Von Richthofen. Span 17⅝", length 14¼", weight 2.3 oz. Now authentically colored silver nose, white rudder and markings. Kit SF-14 **$2.50**

**HOWARD "PETE"**

An easy to build Air Race model—fine flights. Span 15", length 13¼", weight 1.5 oz. All white. Black details. Kit SF-18 **$1.35**

**MONOCOUPE**

Span 24", length 15¼", weight 2.2 oz. Beautifully colored cream and orange. This design has won many first prizes for model-builders. Kit SF-28 **$2.50**

**AERONCA C-3 SPORTPLANE**

Developments of this light plane have proven popular for a number of years and our model's design follows one of the latest designs. Beginners and advanced builders will want to build this fine flying model. Span 27". Very beautifully colored red and silver. Kit SF-40 **$2.65**

**U. S. Army Boeing P-26 Pursuit**

A standard fighter of the army squadrons, this ship is one of the world's fastest pursuit planes. Developed along the lines of modern racers, it is capable of pursuit or light bombing work. Thrilling fast flights. Span 20⅝". Colored yellow and olive drab. Kit SF-23 **$2.50**

**BOEING 247 HIGHSPEED TRANSPORT**

This giant has a span of 55⅝" and a length of 38½", and is nothing less than a wizzard for flights, with its two motors powerfully pulling. It is entirely gray colored and weighs 16 oz. The redesigned model has all curved wood printed-out (an enormous quantity) with data for more authentic building and appearance than heretofore, with "filled-in" fuselage, balanced controls, etc. The thoroughly engineered drawing of four large panels (17"x44"), each contains accurate modeling information and over 16 oz. of liquids, dope, cement, etc., contained within each one of the new giant Kits. Kit SF-35, postfree **$8.50**

**Wedell's Wedell-Williams Racer**

Jimmy Wedell's own racer won Thompson trophy race with it in 1933 and later the land plane speed record. In 1934, Doug Davis won the Bendix Trophy with this same ship. Model is very accurate and excites interest and favorable comment everywhere. Span 19½". Red, black and bronze. Kit SF-47 **$2.95**

**U. S. ARMY BOEING P12-E**

Many employed in U. S. Army pursuit squadrons. Maneuverability, speed, fast climb and ability to dive vertically make them fierce defensive weapons. Model gaily colored like real P12-E with red trimmings, yellow wings, tail and stripes. Olive drab fuselage, also color striped Span 22½". Kit SF-8 **$2.85**

**FOKKER D-VII FIGHTER**

Used by German aces, it earned the reputation of most efficient fighter of the world war in actual service, being fast, maneuverable and could make long dives without shedding its wings. Redesigned model is 100% authentic, and beautifully colored, orange, green and white. Great flights. Kit SF-15 **$2.95**

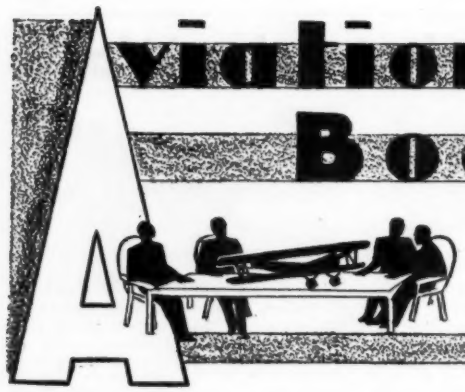
**LAIRD "SOLUTION" RACER**

Charles "Speed" Holman won the Thompson trophy race of 1930 in this biplane. Model is of recent C-D design and employes the best type of model construction. Recommended for those who want an attractive fast flying model. Span 15⅛". Laird gold and black. Kit SF-46 **$2.50**

## Dealers!

We have no magic wand. Neither are we super-men. We are, however, business men who believe that you can use "America's Leading Line of Model Kits and Materials" in your store to great advantage. We believe that if you will give us an opportunity to ship you an order of our famous Kits and materials, to display in your store, you will agree our merchandise has standout QUALITY, AUTHENTICITY, APPEARANCE, and above all, DEMAND. So, why not send for information at once—on your letterhead? Clubs and schools—write too!

# Aviation Advisory Board



Conducted by
CHARLES HAMPSON GRANT
Chairman of the Board
Formerly of
The Technical Section, Air Service, U.S. Army

HERE we are again with a few more questions from our readers. The first question concerns gas models and is from Peter Nadroski of 16 West Lake Street, Easthampton, Mass. He says:

Question: On my gas model the center of gravity is behind the center of pressure and the stabilizer is set at a positive angle. Is that okay or should the center of gravity be ahead of the center of pressure and the stabilizer at a negative angle?

Answer: The position of the center of gravity relative to the center of pressure depends on whether or not your plane is a high-wing or low-wing. If it is a parasol or a very high-wing type, the stabilizer usually must be set at a positive angle in order to prevent the tail from dropping, due to the high line of resistance which has a tendency to push the tail down.

Under these conditions, the center of gravity may be set ahead of the center of pressure slightly. This is dependent upon the intensity or amount of the resistance caused by the wing being well above the line of thrust. If the resistance is large and the speed of the machine high, the center of gravity should be at a point on the wing which is 50% of the chord back from the leading edge. There may be some cases where the center of gravity is farther forward than this, but usually with a positive tail and a high wing, the center of gravity is at this point, especially when the tail surfaces are large; for instance, 30% of the wing area. If they are small it is often required that the center of gravity be ahead of the center of pressure. The tail surface is usually considered small when it is 20% of the wing area.

If the machine is of a low-wing type, the stabilizer should be set at a slight negative angle. The wing should be at zero or not more than one degree positive. The center of gravity may be ahead of the center of pressure in this type of machine more frequently than it is back of the center of pressure. Its exact position is dependent upon the angle of incidence of the wing. The more positive the stabilizer, the further to the rear the center of gravity should be.

If the stabilizer is about neutral, the center of gravity should be about 50% of the chord from the leading edge of the wing. If it is slightly negative, it should be slightly forward to 33% of the chord from the front edge of the wing.

B. Levinson of 1575 Thuriot Avenue, New York City, wishes to know:

Question: Is a propeller template given on a plan of an airplane drawn on the block before the propeller is cut from the block, or after its blades have been cut?

Answer: A propeller blade template is used in all cases to draw a pattern on the propeller blades after they have been cut from the block. If the template was to be drawn on the block itself, it would be a propeller block template not a propeller blade template.

David Greenberg of 90 Pleasant Street, Brookline, Mass., writes us and says:

Question: Please tell me why the covering of the wings of the World War Nieuport had a habit of ripping off in a dive?

Answer: Fabrics pull off wings for several reasons; either the fabric is too light for the maneuver which the plane is making, or it is not tied down to the framework in a proper manner. Obviously, in the case of the Nieuport, there were some structural weaknesses.

In this case we do not know whether the fabric was too weak or whether it was not tied properly to the wing. Unquestionably, this fault could be corrected by making the fabric heavier and by tying it to the ribs at more frequent intervals, or by putting reinforcements over the ribs.

We suspect that in their desire to attain extreme lightness that the manufacturers of the Nieuport plane sacrificed strength.

Here are two questions that we have received from a great number of boys.

Question: What was the largest airplane ever built; landplane, seaplane or amphibian?

Answer: The Junkers DO-X was the largest airplane ever built. It was a landplane.

Question: What was the first airplane to cross the Atlantic Ocean?

Answer: The first airplane to leave America and reach Portugal was the Navy NC-4, piloted by Lt. Colonel H. C. Reade, Lt. E. F. Stone and W. Hinton. It made the trip in May, 1919. However, this was not a non-stop flight. The plane landed at various islands in the Azores, but flew from there to land at Portugal.

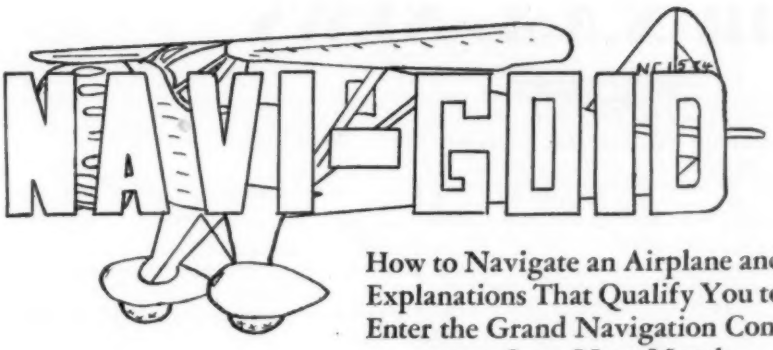
The first non-stop Atlantic flight was made by John Alcock and A. W. Brown on June 14th, 1919. They flew a Vickers 2, powered with a Rolls 375 motor.

We have several questions from Owen Deters of 1251 Rutledge Avenue, Price Hill, Cincinnati, Ohio, which may be of interest to our readers. Here they are:

Question: How is the center of gravity of a model glider or sailplane determined?

Answer: Mr. Deters' question is not exactly clear as to whether he wants to know how to determine the center of gravity after the model is built or while he is designing it. To those who wish to have this question answered we make the suggestion that they read the article, "Aerodynamic Design of the Model Plane" in the November 1934 issue of MODEL AIRPLANE NEWS. *(Continued on page 46)*

**This is the new Douglas DST, A-115 sleeper transport. It will carry 24 passengers by day and has sleeping accommodations for twelve passengers. It has a cruising speed of 190 m.p.h. and weighs 24,000 lbs.**




# How to Navigate an Airplane and Explanations That Qualify You to Enter the Grand Navigation Contest to Start Next Month

By E. SEMLER

*Author's Note:*

**This is the third and last of a series of articles designated to familiarize the reader with the instruments and the correct aerial navigation procedure necessary to arrive at the solution of each NAVI-GOID, a contest which will commence in the next issue. May I suggest that you preserve these three articles for reference during the contest activities as you will find them the simplest guide available.**

---

CHARLES MONTGOMERY sat in the traffic supervisor's huge swivel armchair. On the desk before him was a chart of the North Atlantic, a pencil, a pair of dividers, and a protractor.

At his elbow sat Captain Nicholas Carroll.

"Suppose we say you took off from a position of 20° Longitude and 50° Latitude at 2:00 P.M., Tuesday," the Captain began.

"That would be here." The youth placed a heavy dot on the intersection, and marked it "Point of Departure."

"Correct," Carroll agreed. "Now this scale of miles at the bottom of the chart is useless to us." He reached across and marked it out with a gigantic X. "Because there is only *one* place on a *chart* where a prepared scale of miles in accurate."

"So," he continued, "that brings us down to business. You will remember that I gave you ten cardinal points to remember which are necessary to find your exact 'position,' after you have flown a number of hours. Those ten were: (1) Time (2) Altitude (3) Airspeed (4) Groundspeed (5) Drift (6) Deviation (7) Variation (8) Whether you are using a chart or a map? (9) True scale of miles (10) Magnetic compass bearing.

"Here are the readings for your calculations:

(1) TIME: 5:00 P.M., Tuesday.
(2) ALTITUDE: 10,000 Feet.
(3) AIRSPEED INDICATOR READING: 100 m.p.h.
(4) GROUNDSPEED: 120 m.p.h.
(5) DRIFT: 10° South.
(6) DEVIATION: None.
(7) VARIATION: 15° Westerly.
(8) CHART OR MAP: Chart.
(9) TRUE SCALE OF MILES: 69 miles to 1° Latitude.
(10) MAGNETIC COMPASS READING: 250°.

"Now you make your calculations, and explain them as you go along."

The youth nodded "Yes, sir. First we have *time:*

5:00 P.M., Tuesday.....Present Time
2:00 P.M., Tuesday....Time of Departure.
—
3 .....Hours Flown.

so we know that we have been flying three hours.

"Now, the *Altitude* does not have to be known, if we are not going to determine the airspeed. Nor is the *Airspeed* needed if we have a known groundspeed. Only when we are unable to determine the groundspeed, during fog, storms, etc., is it necessary to use the airspeed and altitude to find a position.

"The *groundspeed* is 120 m.p.h. So if we have been flying three hours at 120 m.p.h., the distance flown will be 360 statute miles (3x120 equals 360).

"The *Compass* read 250°. The variation was 15° Westerly, which must be subtracted to find the true bearing. (250—15° equals 235°). The true bearing would be 235°.

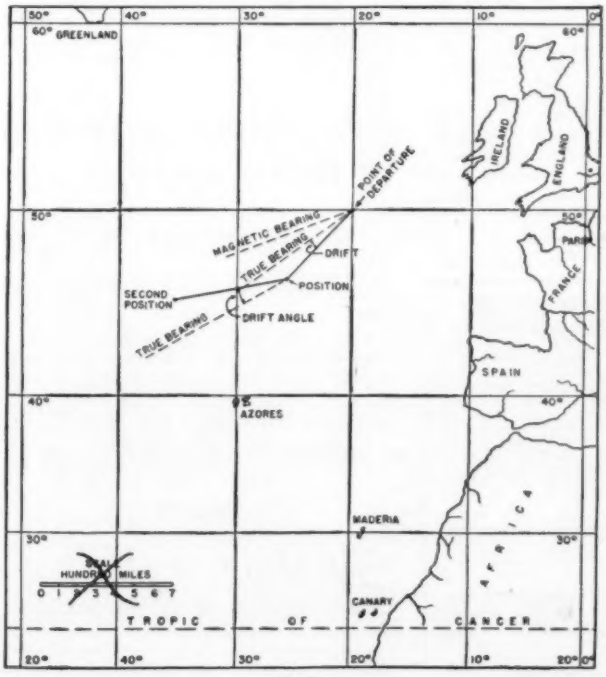
"The *Drift* was 10° South. That is 10° South of the true bearing.

"Now, the chart has a distance scale of 69 miles to 1° Latitude. So now to find out how much one degree of Latitude is between 40° and 50° on the chart." He drew a diagram (Figure "MM"). If one degree was 69 miles, then 360 miles would be 5 degrees and 22 minutes (5°22′). Then he transferred the 5°22′ distnce with his dividers to the map and found the progress of the plane.

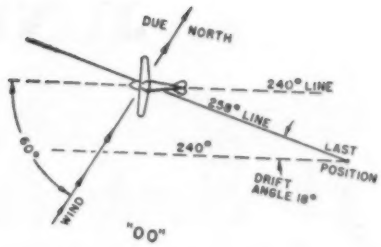
"This point," he declared, "Marked *position*, is the found location, and this solid line is the path or course."

"Fine," the Captain cried, "That's smashing it right on the nose. But wait! I'll give you another that's a little harder. Try

*(Continued on page 44)*

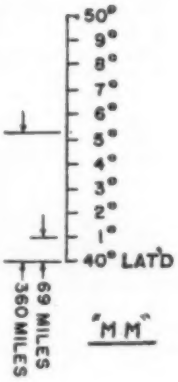



"EE"




"OO"

Article No. 3




"MM"

| TABLE OF WIND AND DRIFT | | | | | | | |
|---|---|---|---|---|---|---|---|
| AIRSPEED M. P. H. TRUE | | | | | | | ANGLE OF DRIFT |
| 60 | 70 | 80 | 90 | 100 | 110 | 120 | |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 | 5° |
| 6 | 7 | 8 | 10 | 11 | 13 | 14 | 6° |
| 7 | 9 | 10 | 12 | 13 | 15 | 16 | 7° |
| 9 | 10 | 12 | 13 | 15 | 17 | 18 | 8° |
| 10 | 11 | 13 | 15 | 17 | 19 | 20 | 9° |
| 11 | 12 | 14 | 17 | 19 | 21 | 22 | 10° |
| 12 | 13 | 16 | 18 | 20 | 22 | 23 | 11° |
| 13 | 14 | 17 | 20 | 22 | 24 | 26 | 12° |
| 14 | 16 | 18 | 21 | 24 | 26 | 28 | 13° |
| 15 | 17 | 20 | 23 | 26 | 27 | 29 | 14° |
| 16 | 19 | 21 | 24 | 27 | 29 | 30 | 15° |
| 19 | 22 | 24 | 27 | 31 | 34 | 37 | 17° |
| 21 | 25 | 28 | 31 | 35 | 39 | 42 | 19° |
| 23 | 27 | 31 | 35 | 39 | 43 | 47 | 21° |
| 26 | 30 | 34 | 38 | 43 | 47 | 52 | 23° |
| 28 | 33 | 38 | 42 | 47 | 52 | 57 | 25° |

"NN"

# JUNIOR N.A.A. NEWS

**Prepared by National Aeronautic Association, Dupont Circle, Washington, D. C.**

### 1936 National Championship Meet

THE dates of the 1936 National Championship Meet have been set for June 30th to July 2nd inclusive, it having been decided at a meeting in St. Louis during the 1935 Meet that three days of flying would better handle the large number of events, than the two days which had previously been allotted to the National Meet program. As usual, registration will be handled during the day immediately preceding the contest dates; however, late comers may register upon arrival as previously.

This year's program will embrace the same events as were contested during the 1935 Meet, with the addition of the Wakefield Competition. The 1935 Wakefield Competition was won by Gordon Light of Lebanon, Penna., who now has possession of the Lord Wakefield Cup. It is one of the rules of this competition that the contest be held in the country which holds possession of the cup.

Akron, Ohio, has been tentatively designated as the location of the 1936 Meet and arrangements are at present being perfected. Complete rules and detailed information will be found on these pages in next month's issue.

### Membership

IT was decided recently to eliminate, for a time at least, the group form of Junior Membership and to place all Junior Members on an individual membership basis. This means that all Junior Members will be accepted on the basis of 50c each for the first year and will be asked to pay only 25c for a renewal of their membership. If twenty-five or more Junior Members, on the above basis, desire to form a Chapter, they will be granted a Junior Charter. Therefore, it will be necessary for all of the present members, who have been enjoying the former greatly reduced Chapter dues, to renew their membership upon expiration as individual members at the 25c rate.

This decision was made by the National Aeronautic Association after considerable thought and discussion, because under the former low priced membership plan, it was impossible economically for the association to give its Junior Members the amount of service which the Association has always desired to give to its members.

Plans are under way in the Washington Headquarters' office to issue monthly bulletins, which are to be distributed to the various Junior Chapters. These bulletins will serve to keep all units of the organization in close touch with the developments as promptly as possible.

Major L. Williams, N.A.A. Vice-President, is taking an active and enthusiastic interest in the Junior affairs and, together with the Association's President, Mr. Charles F. Horner, is working on a detailed set-up for a much larger and more extensive Junior Membership program.

THE National Aeronautic Association offers model builders and flyers membership in a national aviation organization that insures recognition of record-making flights, bulletins that will keep you up to date in the latest refinements of the art, together with the realization that you are working right along with the leaders in national aviation. The Association aims to keep "America First in the Air." Those under 21 are entitled to membership as junior members at 25 cents a year with an additional initiation fee of 25 cents. Those over 21 may become regular members at $3 a year. A special model flying permit is offered to non-members who are over 21 at $1 a year.

Only N.A.A. members or those with special permits are eligible to compete for N.A.A. trophies and awards, or to have their flights given official recognition for record purposes.

NATIONAL AERONAUTIC ASSOCIATION OF U.S.A.
DUPONT CIRCLE
WASHINGTON, D.C.

I hereby make application for membership in the National Aeronautic Association as a Junior Member, I am under twenty-one years of age.

☐ I enclose fifty cents for initiation fee and first annual dues (Use check or money order).

☐ I enclose twenty-five cents for renewal.

Name.....
(Please print or type)

Street.....

City..... State.....

Date of Birth.....
(Month, Day, Year)

Approved.....
(Parent sign here, if applicant is under eighteen)

### Model Builders' and Flyers' Association

FOR a long time the serious model plane builders and flyers have been advocating associations of their own within the Junior N.A.A. structure, similar to many others; such as the Soaring Society, Racing Pilots' Association, Sportsmen Pilots' Association, etc.

At the 1935 National Meet in St. Louis a tentative plan for this very thing was drawn up. This plan has been submitted to a large number of model plane enthusiasts, who have endorsed it heartily. Therefore, the Association has decided to let the leaders of this group of scientific builders and flyers form their own association with a close affiliation with the N.A.A. This will insure that all model plane contests and records trials will be conducted under N.A.A. regulations and supervision.

This phase of N.A.A. activity will, for the most part, be under the Parent Association's Contest Committee. It is intended that membership will be open to any model builder, flyer or enthusiast, regardless of age. The organization of this association has already been started and it is believed that complete details will be worked out and published in next month's issue of this magazine.

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### Air Ways Here and There

*(Continued from page 21)*

the negative of the model. Another picture was then made from the composite negative. It is very realistic to say the least.

Many builders who have tried to get photographs of planes in flight realize what a difficult task it is. In light of this, Charles Kennett of 203 Slater Street, Webster, Mass., deserves much credit for picture No. 8, which shows his Consolidated Fleet Trainer in flight. This model was built from plans appearing in MODEL AIRPLANE NEWS. The picture certainly demonstrates the flying capacity of this model.

Over a year ago, plans appeared in this magazine for a flying scale Russian Fighter. This is one of the first scale models of a Russian ship ever to have been published. Lawrence Cline of 304 Weequahic Avenue, Newark, New Jersey, built a model from these plans and sends us picture No. 9, which shows the careful job he has done. He tells us that he has had some very excellent flights with it.

### MODEL NEWS FROM OTHER COUNTRIES

#### Japan

One of the leaders in model aviation in Japan is Mr. H. Minowa of No. 3 Wakamatsucho, Ushigome, Tokyo, Japan. He has been kind enough to send us considerable data on Japanese model builders from time to time, including picture No. 10. It shows him (left) and K. Katoke of the

★ ★ ★ ★

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**CURTISS P6-E ARMY HAWK**
A faithful model of one of Uncle Sam's fastest fighters. Kit is complete, containing everything necessary to build a beautiful flyer.

**WACO MODEL "D" MILITARY**
The most modern fighting model of a bi-plane design. Very beautiful and unusually well detailed. Authentic as only SCIENTIFIC makes them.

**GRUMMAN FIGHTER SF-1**
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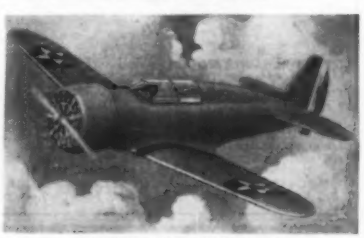
**ART CHESTER RACER**
Another ship needing no introduction since it has made a swell showing for itself at the National Air Races. The kit is complete in every respect. You will be more than satisfied with it.



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The most modern pursuit model of a low wing design. A perfectly detailed model airplane kit with many finished parts including full insignia.

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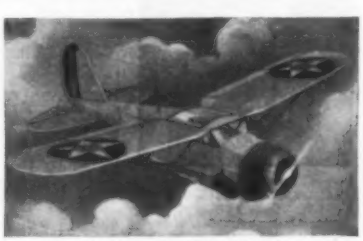

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**In Australia: Swift Model Aircraft, 107 Adelaide St., Brisbane, Queensland**

Nishiki Model Club. These two gentlemen are busily preparing a compressed air model of the Japanese "93" Bomber, for flight. Careful examination of the picture will show that the model has been constructed in complete detail. The workmanship is exceedingly fine. It is unusual also in the fact that it mounts two motors. The air tank is in the fuselage. Mr. Minowa tells us that this model has flown about 3000 feet. For those builders who cannot afford the expense of gasoline engines with which to power their models, compressed air motors are proving very satisfactory. The only trouble is that a little more work is required in operating a compressed air job. If you don't believe this, sometime try to pump a tank up to its full pressure.

## England

Picture No. 11 shows two ships marooned in the snow. Apparently they are full size ships, but actually they are only a couple of Lockheeds built by L. S. Wigdor of 2 Windsor Road, Church End, Finchley, London N.3, England. Mr. Wigdor now has a fleet of fourteen scale models built to ¼" to the foot. Wigdor is making excellent use of the means provided by model building to become an aeronautical engineer. He tells us that he intends to take up this profession and is now attending a university and pursuing his studies in this field.

## New Zealand

To show American builders that they are building contest models in New Zealand, W. B. Mackley of 8 Ascot Avenue, Remuera S.E. 2, Auckland, New Zealand, has sent us picture No. 12, which shows his weight rule 200 square inch fuselage model in full flight. He says:

"In Auckland model flying is rapidly increasing in popularity and many worthy records have been put up. Mr. U. B. Gray recently put up a flight of six minutes, twenty-nine seconds indoor with a microfilm job. Outdoor records range from four to eighteen minutes."

## Australia

Mr. Freshman has been kind enough to send us news and some of the official records made by members of the Model Flying Club of Australia. The record for Class C Fuselage R.O.G. model is fifty-two minutes, forty seconds made by Jack Brown of Albury. For Class D Stick Tractor the record is twenty-eight minutes, twenty-seven and two-fifths seconds made by Gordon Ratcliffe of New South Wales. The Flying Scale record is held by Gordon Davidson, N.S.W., who hand-launched his Fairchild 22 on an official flight of one minute, thirty-one seconds. The Rise Off Water record is held by Mr. B. Pearl of Toorak, Victoria, who flew his stick tractor off the water for eight minutes.

There is no change in the indoor records from the last reports. That is to say, E. G. Leighton of Malabar holds the Fuselage record of three minutes, thirty-three seconds, R.O.G., and J. Jago of Malabar holds the Stick Tractor record with seven minutes, forty-five seconds. All these are official records.

One of the events at one of the recent contests was extremely interesting. It was a speed race. Mr. Freshman says:

"We had never held such an event before and the course we selected was rectangular, making it necessary for each competitor to fly his machine around pylons near which were stationed stewards and judges.

"Out of sixteen entrants only eight men faced the starter, and their handicaps provided that they would fly off at irregular intervals, the scratch men being those who had had previous experience at racing model aeroplanes. Although spare propellers and motors were carried, each competitor had to finish the race with the original fuselage and wing. The little red monoplane flown by young Don crossed the finishing line first, followed by the second man, Irwin Luke, after an interval of two and a half minutes, and he with only one longeron left whole in his fuselage, and even it broke on the last landing made by the machine, and Mr. E. Luke, Sr. finished third one minute and a quarter behind Irwin. The total time taken for the race was seventeen and a half minutes, which constitutes a very fair time for a mile race flown on a rectangular course in such a high wind. The prize was a silver cup, donated by a member of the New Zealand Model Flying Club, and the second man was awarded an Australian Broadcasting Commission's medal as a reward for a particularly plucky fight."

*(Continued on page 32)*

## CLUB NEWS

### Salem, Ohio

Mr. Herbert F. Kelley, instructor of the Salem Junior High School Model Clubs, sends us information concerning their activities and picture No. 13 of a Martin Bomber Y-10. It is fifty-three inches in wing span and the wings, fuselage and tail surfaces are entirely covered with 1/32" balsa wood. Real electric flashlight bulbs are in the wings. It was built by Mr. Kelley and took exactly one year's work to complete, which amounted to 600 hours of labor. Builders of this type of model can well appreciate the details embodied in this ship. If this is a sample of the work of the club, its members must certainly be well up in the art of model building. Mr. Kelley writes us:

"We have at least six model contests each season, all of which are well attended. Many of the boys are interested especially in 'solids' while others prefer the flying type. Every three weeks our contest is for replica models, then the end of the following three weeks the 'high fliers' have the limelight alone.

"Your excellent publication is our everyday guide and always proves to be the most worn of all our magazines by the end of the month."

### Syracuse, New York

Henry B. Westhoff of 803 Teall Avenue, Syracuse, New York, sends some news of the Syracuse Model Airplane Club, and also picture No. 14 of his absolute scale NC-4. The span of the ship is 16¼" and is built to a ⅛" scale. It required seven months to complete and is of solid balsa wood. Building models of old types of ships is a considerable task due to the style of rigging used in some of the antiquated planes. For instance, this model contains 225 individual brace wires. The motors are well detailed. This model took second place at a contest held by the Syracuse Model Airplane Club recently. An interesting feature of this ship is its stability when in the water. It rests perfectly on the water line.

### Here and There

So encouraging was the response of Model builders of the eastern seaboard to the short notice given them of the Eastern States Indoor Championship Contest, scheduled for Christmas Vacation week, that the sponsors decided to postpone this event to Easter Vacation week. The postponement will allow a good deal more time for preparation for both the contestants and sponsors.

The Eastern States Indoor Championship Contest will be held sometime about the 10th of April at an armory to be announced later. Applications may be obtained by writing or calling at Polk's Model Craft Hobbies stores at 421 Seventh Ave., New York City or 263 Halsey Street, Newark, New Jersey.

The following events will be conducted: Rise off Ground Class A, Hand Launched Stick Endurance Class B or C and Rise off Ground Cabin Class B or C. This contest is sanctioned by the National Aeronautic Association and will be conducted under Association rules.

There is a possibility of there being a non-flying scale model event in conjunction with this meet. This however, is pending the final decision of the Contest Committee at the time of the publication of this issue. Those interested in such an event are asked to communicate with Polk's Model Craft Hobbies Inc. stores for further details.

Some exceptionally long flights have been reported by the Central Model Aero Club of Stevens Point, Wisconsin. In view of the fact that there is no suitable place for indoor flying, this organization flies outdoor models almost exclusively.

Members of the club have made flights with a cabin model of over twenty minutes, twin-pusher flights over twenty-one minutes. Tow-launched gliders have been flown out of sight after flights of eleven minutes.

Three inter-club contests were held this summer between this and the Midwest Model Club of Green Bay, Wisconsin. At present the club is constructing a five foot compressed air model and is contemplating building a gas model in the near future. Several of the members are planning to attend the next national meet.

Charles Kohls is president and Harold Hemmis is club secretary.

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The St. Catherine, Ontario, Y.M.C.A. has been conducting a model airplane club with a membership of fifty for the past three years. Classes and meetings are held every Saturday night from September to May inclusive. The club holds several Ontario and Canadian records and issues a weekly bulletin.

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Word reaches us that the Aeronca Corporation are sponsoring a model building contest of their well known ship, the Aeronca. Twenty prizes worth $1,000.00 are offered. The contest is divided into two groups, senior division for which the 1st prize is an amateur pilot's flying course and six weeks room and board in Cincinnati or cash equivalent and junior division for which the first prize is $100.00 in cash. Registration blanks may be obtained by writing Aeronca Model Airplane Craftsmanship Contest, P. O. Box 80, Cincinnati, Ohio.

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### Junior Aviators

The Junior Aviator Unit in Cleveland, which is sponsored by the Cleveland Press has a membership of over 50,000, ten thousand of whom are model builders.

Every boy or girl joining the organization becomes a rookie. From this point on, it becomes a matter of skill. If the member is good at building and flying models, he is classified in the air group. Any boy in the organization can rise to the top through ingenuity and diligent work. The following are the commissions with the requirements.

Lieut.—30 seconds indoor flight or 10 seconds outdoor flight. Either stick or fuselage model can be flown in all classifications.

Captain—Two minutes indoor or three minutes outdoor.

Major—Four minutes outdoor or six minutes indoor.

Colonel—Ten minutes indoor or fifteen minutes outdoor.

Ace—Fifteen minutes indoor or twenty-five minutes outdoor.

*(Continued on page 45)*

# ATTENTION unsuccessful MODEL BUILDERS!

## *To everyone who ever FAILED to build an All-Balsa-Stick Kit*

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Knowing the many advantages SELLEY-TEX has over All-Balsa-Stick Kits, we make this offer confident that you'll find SELLEY-TEX "moulded" construction the type of kit you have always longed for but could never get. This revolutionary, simplified method is giving more "building" pleasure and more "satisfying" results to novices as well as experts, than any All-Balsa-Stick Kit on the market possibly could. **FOR IF YOU CAN'T BUILD A MODEL PLANE THIS NEW EASY WAY, YOU CAN'T EVEN BEGIN TO CONSTRUCT THE OLD-FASHIONED, ALL-BALSA WOOD KIT!** And we issue this Full-Money-Back Offer in order that YOU can find out for yourself the difference SELLEY-TEX "moulded" construction makes in the successful building of true-to-scale, fast flying miniature planes.

We know model builders like SELLEY-TEX, once they try this Modern Method of Model Building. Since the introduction of these LOWER PRICE "star" SELLEY-TEX Construction Sets, thousands of these kits have been sold. **WE HAVE NOT HAD A SINGLE KIT RETURNED OR RECEIVED ONE LETTER OF COMPLAINT.** No greater tribute to the SUPERIORITY and VALUE of SELLEY-TEX is possible! We are constantly getting testimonial letters and repeat orders from those who have changed to SELLEY-TEX and found new enjoyment, new benefits. We want you to share their enthusiasm. TRY SELLEY-TEX! Read the coupon below and ACT NOW!

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**(Signed)**

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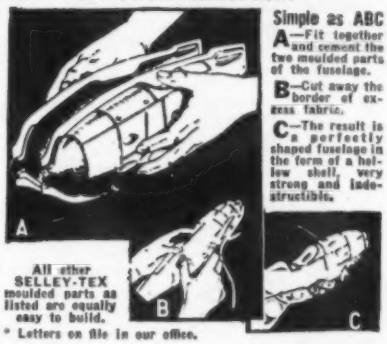
**Each of the SELLEY-TEX Construction Sets contain the necessary individually designed moulded scale parts similar to those shown above.**

Wing Span 20" Length ....12¾"

* "After my friends showed me the easy SELLEY-TEX method of building the difficult parts of a model. I decided to discard the old way and have built your Lockheed Orion for our annual Hobby Show."

**LOCKHEED ORION** $1.25 15c Postage

**An amazing realistic replica of this famous transport.**




**Simple as ABC**

**A**—Fit together and cement the two moulded parts of the fuselage.

**B**—Cut away the border of excess fabric.

**C**—The result is a perfectly shaped fuselage in the form of a hollow shell, very strong and indestructible.

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WING SPAN, 20" LENGTH 12½" **MONOCOUPE**

**A beautiful miniature of the popular original and what a flyer!**

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WING SPAN 18" LENGTH 13¾" **VOUGHT CORSAIR, JR.**

**This latest formidable looking military plane complete with guns, bombs, etc., is built for stamina and designed for speed.**

### READ CAREFULLY these 10 ADVANTAGES SELLEY-TEX offers over All-Balsa-Stick Kits!

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★ **EXCLUSIVE FABRIC.** Specially close woven and processed by secret formula. The smooth moulded surface can be beautifully finished in any color combinations with dope or lacquer.

★ **EASIER-TO-BUILD.** The moulded parts make it simple as A B C. Novices as well as experts easily and successfully build and fly planes this new simple way.

★ **MORE PRACTICAL.** Selley is discontinuing All-Balsa-Stick type of kit entirely. An analysis showed that less than 2% of those who try, can actually complete an All-Balsa-Stick Kit!

★ **MORE AUTHENTICALLY DESIGNED.** Minute details are moulded into model. Each is an exact, true-to-scale miniature of the original plane perfect in every detail.

★ **MORE DURABLE.** The moulded fabric shells are stronger though lighter. They will not warp, tear or puncture and are practically crash-proof and unbreakable.

★ **BETTER FLYERS.** The moulded fuselage eliminates weight behind center of gravity which is approximately 95% perfect in all models assuring better flying performance.

★ **POSITIVE MEANS OF BALANCING.** Simple ring device correctly balances plane. A new clever feature found only in these moulded models.

★ **PATENT APPLIED FOR.** The moulded process is an original creation owned exclusively by Selley.

★ **MONEY BACK GUARANTEE.** A full protection money back guarantee certificate is included in every kit!

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Wing Span 16" Length .....10" **REARWIN SPORT**

**Simple to build and realistic in all details! A great flyer too! Wonderful Value!**

* "If the Bellanca Swoop kit is one-third as excellent as your $3.00 Ryan Sport I built, I am truly getting full value for my money. Lots of luck to SELLEY-TEX!"

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**A perfect authentic reproduction of this famous London to Melbourne racer.**

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Wide-awake merchants will appreciate the tremendous sales appeal of these new competitively lower price SELLEY-TEX kits. CASH IN on these exclusive sell-on-sight sensations. Write today for complete information, discounts, etc.

**PARTS AND ACCESSORIES**

Every model is packed in a beautiful, sturdy box with semi-finished flying or scale propeller, formed wire hooks, sealed wheels, with brass bushings, ribs printed out accurately on white sheet balsa, many special turned wood parts, finest grade of balsa wood sticks, tail wheel and fork fittings, and wire, pure para rubber, colored paper, authentic markings, colored insignia, best quality cement, colored dopes, full-size easy-to-understand plan.

**Space does not permit illustrating any of the six models which comprise the DE LUXE line of SELLEY-TEX Flying Scale Model Construction Sets. All 24 inch wing span. Complete with all tools necessary to build model. For full listing, order from coupon or see FREE offer below!**

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**A brand new supply catalogue picturing and listing the most popular plane accessories is yours for the asking. Send 3c for postage.**

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WING SPAN 18½" LENGTH 13½"

**Exceptional flight performance, authentic beyond belief. Full military equipment, guns, bombs, etc., for realism.**

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Please send me the SELLEY-TEX model kits I have checked. I am enclosing $..... (check or money order.) (Each plane 15c postage. West of Denver 25c postage.)

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## Choosing a Model Type for Stability

*(Continued from page 19)*

the heavy landing gear adds materially to the stability and is therefore required.

Now what about the line of resistance? The resistance of the wings amounts to the greatest part of the total resistance of the airplane and it acts at the Center of Lift in a rearward direction parallel to the direction of flight. Actually it is about four times the resistance of the wheels and landing gear struts if they are made of wire. The center of resistance of these two drag forces then will coincide approximately with the arrow marked LR, Fig. No. 110. The center of resistance of the motor stick rubber propeller and tail surfaces will be very slightly above the line of thrust (the center line of the rubber motor) as the fin extends upward from the motor stick and causes drag *above* the stick. Actually in this case, the C.R. of these parts will be about on the line marked C.R. Then we may say that the total resistance of this type of plane can be established on the line (CL), when the motor stick and the rubber motor is in the position shown in the figure. The line of thrust is therefore in the desired position too.

The next consideration is the arrangement of weights of the structure. They should be kept as close to the C.G. as possible. If it is required that certain parts be placed in a position remote from the C.G. then they should be as *light* as possible.

The model in Diag. No. 1 has one untapered wing. The center of gravity of such a wing is located approximately at the center of area. In other words very slightly above the C.L., (see effect of aspect ratio, article No. 2, March 1932) and fairly close to the C.G. It could only be brought closer to the C.L. in the Fig. by lowering the wing and thereby the C.L. of the wing. The latter procedure is very undesirable.

Apparently if the wings are made with a taper, the center of gravity of each half wing will be closer to the wing center and therefore lower because of the dihedral. However, if this is done the C.L. or (CP) will be lowered too, for the C.G. of any wing is always close to the C.L. of that wing. When a tapered wing is used however, the rolling moments about the longitudinal axis are less. This is due to the fact that the center of weight of each *half* of a tapered wing is closer to the motor stick or the longitudinal axis. The moments that resist roll are also less so the model is disturbed just as easily and recovery from a displacement is not improved because the center of area of each half wing is also closer to the motor stick. Therefore, it is evident from this standpoint that a normal straight wing will serve the purpose of stability equally as well as a tapered one, as far as weight distribution is concerned.

Now what about the length of the nose of this type of model? It should be short to attain best results. The length of it depends upon the balance of the model. A heavy landing gear has been specified to create a low C.G. If this is placed at the extreme nose of the model, its weight in such a position will cause the center of gravity to be located well forward. Thus the distance from the C.G. to the nose of the model will be comparatively short, as desired.

This condition also has an effect on the size of the tail surfaces and, therefore, on their weight. They can be made smaller than they would have to be made if the nose should be long. This of course means that they can be made comparatively light which is a contribution to stability.

It is evident from these considerations that the type of model in Diag. No. 1 is well suited for stability. However, perhaps some of the other types will do as well. Let us see. In Diag. No. *2* a single propeller pusher monoplane is pictured. If this type of model is analyzed in the same way as the model in Diag. No. 1, it will be found that the same set-up of forces can be obtained with it as shown in Fig. No. 110. However, there are two features in its arrangement that cause it to be less stable than the tractor type of Diag. No. 1.

First, the motor stick must extend out in front of the model for a considerable distance in order to balance the added weight of the propeller to the rear of the C.L. Also it must compensate for the fact that landing gear is farther back and does not help to balance the weight of the tail. This produces a condition in which the weights of the structure are more remote from the C.G. than in the case of model No. 1.

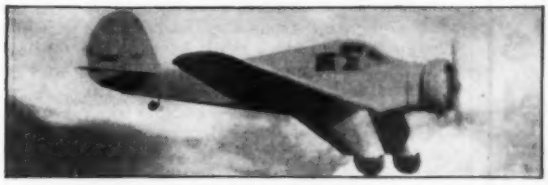
By this it is not inferred that this type of model can not be made stable. By clever design it can be made as stable as certain forms of model No. 1. But the same ingenuity applied to model No. 1 will produce a more stable airplane.

The second feature of model No. 2 that detracts from its stability is the proximity of the propeller to the stabilizer. The condition that helps to correct a stall is the change of the speed and the angle of attack of the air on the stabilizer. When the stabilizer is close to the propeller, it is directly in the slipstream which produces a stream of air of nearly constant speed and angle of attack over the stabilizer, even when the plane is in a stall. The angle of attack of the air outside of the slipstream has some effect upon it, but not as much as when the propeller is at the nose of plane. In the latter case, any variation of the angle of flight of the plane affects the stabilizer greatly. Actually the slipstream of a pusher propeller destroys this effect to a considerable degree. The only way to correct the trouble in this case is to place the stabilizer a considerable distance from the propeller at the end of long outriggers. However, this brings other difficulties into the problem. It makes the tail heavier and requires that the nose be made heavier to bring about the correct flight balance of the model.

Next suppose we consider the model shown in Diag. No. 3. This one is similar to model No. 1 in all respects except the wings. Model No. 3 is equipped with wings in biplane arrangement.

A model of this type can be made with exactly the same set-up of forces as model No. 1. The arrangement of the structural weights will be slightly dif-

# BUILD THIS 1936 LOW WING AERONCA MODEL



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**HOW TO WIN! Merely build the best model of the famous new 1936 Low Wing Aeronca and send it in.** This great national Model Airplane Craftsmanship Contest is sponsored by Aeronautical Corporation of America to help foster aviation in its broadest sense; in interesting men and boys, women and girls of all ages in the basic fundamentals of flying through the building of model planes.

### • RULES

1. Prizes will be awarded in two divisions: *"Seniors"* (those 16 years of age or over) *"Juniors"* (those under 16 years).
2. Prizes will be awarded for the best models of the new 1936 Low Wing Aeronca in each division.
3. Models built before March 1, 1936, may not be entered.
4. All planes must be received at Aeronca Contest Headquarters, Cincinnati, Ohio, not later than Monday, July 6, 1936.
5. Judging will be held during week of July 6th.
6. Decisions of the Judges will be final and uncontestable. All contesting planes will be returned.
7. Models will be judged according to craftsmanship, points being awarded as follows: Accuracy of scale, 30 points; workmanship, 30 points; covering, 20 points; finish, 20 points.

### • PRIZES

| | SENIOR DIVISION (those 16 years of age or over) | JUNIOR DIVISION (those under 16 years of age) |
|---|---|---|
| | 1st Prize—Amateur Pilot's Flying Course and 6 Weeks' Room and Board in Cincinnati, or Cash Equivalent | 1st Prize — $100 Cash Award. A good start on a fund for learning to fly when you are 16. |
| | Cash Awards | Cash Awards |
| 2nd | $100.00 | $50.00 |
| 3rd | 75.00 | 25.00 |
| 4th | 50.00 | 15.00 |
| 5th | 25.00 | 15.00 |
| 6th | 15.00 | 15.00 |
| 7th | 15.00 | 10.00 |
| 8th | 10.00 | 10.00 |
| 9th | 10.00 | 10.00 |
| 10th | 10.00 | 10.00 |

### • The Official AERONCA Contest Kit

This is the most authentic and complete model airplane kit ever offered model builders. Designed under the personal supervision of Mr. Giles Barton, designer of the Aeronca Low Wing, it is a beauty to behold. Printed Balsa wood, generous supply of lacquers of the proper colors, cements, tissues, pyralin and wood parts, make this an exceptionally fine value.

### • JUDGES

Capt. A. B. Wunder, Supt. Lunken Airport
Mr. Roger Schlemmer, Chief Engineer, Aeronautical Corporation of America
Mr. Giles Barton, Designer of the Aeronca Low Wing
Mr. H. E. Coovert, Aeronautical Engineer
Mr. Seymour Dunham, Aeronautical Engineer

## • ENTER THIS EXCITING CONTEST • SEND COUPON TODAY

**Aeronca National Model Airplane Craftsmanship Contest**
**P. O. Box 80 Cincinnati, Ohio**

M.A.N.

• Gentlemen: Please enter me in the Aeronca National Model Airplane Craftsmanship Contest. (Check in one box only)

☐ I am enclosing P. O. Money Order for $1.50 plus 15c in stamps for which please rush me the official Aeronca Construction Kit. Immediately upon receipt of this kit I will fill in the Official Registration Blank contained therein and send it to you.

☐ I am enclosing P. O. Money Order for 75c plus 6c in stamps for which please rush me the Complete Plans for building the Official Aeronca Contest Model. I am using my own materials.

☐ I am building my plane from my own plans and materials. Please send me official registration blank. I am enclosing stamped, self-addressed envelope

Name .....

Street Address ..... Age ..... years old.

City ..... State ..... Birthday .....
Month, day, year

Check, Senior Div. ☐ Junior Div. ☐

ferent, however. Let us see what effect they have on the stability of the ship.

The center of pressure of a biplane combination is at a point between the wings, which is located a distance of ⅜ of the gap up from the lower wing. Therefore, the wings will have to be mounted on the model so that this point coincides with the C.L. in Fig. No. 110. Actually the center of weight of the upper and lower wings will be half way between the two wings and slightly *below* the point of the C.L. This condition brings the center of weight of the wings nearer to the C. G. than in the case of the monoplane and thereby the stability is improved. However, they must have 25% more area to give the same total lift, due to its inefficiency being less than the monoplane. Inter-plane struts are required also, so the weight of the biplane wings is therefore more than 25% greater than the monoplane wing. This fact more than overcomes the advantage of the wings being closer to the C.G. On the other hand, if the tail moment arm is kept the same as in the case of the monoplane, the stabilizer can be made about 30% smaller due to wing chords being about 30% less than the monoplane. Thus the tail planes are lighter in weight than those of the monoplane. This *reduces* the inertias which fight recovery from displacements while in flight, and approximately balances the detrimental effect of increased inertia of the wings about the C.G. In other words the biplane can be made just as stable as the monoplane if the same tail moment arm is used in both cases. However, the biplane span being less will give one the impression that the tail moment arm is excessively long, which it is from a proportional sense.

If the moment arm is shortened to the same proportion of the wing span as the monoplane, the stabilizer and fin must be the same size as the monoplane tail surfaces. Thus the tail surfaces are heavier and have more inertia than if the moment arm is long. However, they are nearer to the C.G. which fact compensates for their greater weight, so in any case the stability of the biplane can be matched with the monoplane.

This type of construction can be used consistently therefore, to fulfill our purpose. The only disadvantage is its more complicated construction and greater weight. The latter factor will of course reduce its flying ability. Under these conditions the monoplane would give greater satisfaction though the stable qualities are the same in both cases.

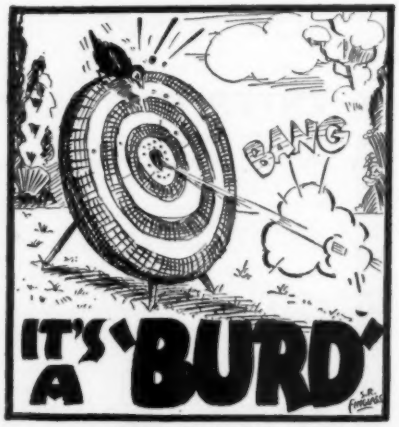
In Diag. No. 4 a triplane model is shown. The same reasoning would apply here if this was a tractor type, as models No. 1 and 3. It can be made as stable as the monoplane but its flying qualities will be much less because of greater weight and less aerodynamic efficiency. In this respect it is not as desirable as the biplane type of model.

As far as stability is concerned, the pusher biplane or triplane has the same values as the pusher monoplane in Diag. No. 2. The triplane has slightly less stability than the monoplane of this type, if there is any difference.

Our next possible consideration is the *single propeller tandem monoplane pusher*. Obviously it is very difficult to produce the force arrangement of Fig. No. 110. In order to be sure of a high center of lift the wings would have to be raised well above the motor stick. This would bring the C.G. below the C.L. due to the weight of the motor, stick and propeller. A large dihedral, especially on the front wing would do this also. However, the C.G. then would be above the line of thrust which would not decrease its stability in power flight, but would cause a steep and fast glide, unless the wings were set so that excessive stalling would be produced at the start of the flight under power. This fault might be tolerated but the feature that causes great lack of steadiness and consequent efficiency in flight is the remote location of the weights of the various parts of the structure. For example, the motor and frame are very long and extend a great distance to the front and rear of the C.G. Also the propeller and front wing are very remote from the C.G. This is liable to cause poor fore and aft recovery and lack of steadiness especially in gusty or turbulant air. Probably many readers have experienced this very condition while flying tandem pushers.

A third drawback is the fact that the twist of the frame due to the motor torque tends to turn the model in the same direction as the propeller torque, (air reaction on propeller). This produces such a large lateral turning moment that the plane usually rolls over sideways at the start of the flight. Only excessive elevation of the front plane and careful balance will overcome this characteristic. In other words this type of model is not stable but very "critical."

The two propeller tandem pusher monoplane has all of the bad features of the single propeller type except that the frame twist and propeller torque is neutralized by having the propellers turn in opposite directions. It has its own characteristic weakness, however. The motors, sticks and propellers are located a considerable distance out from the center of gravity. This causes greater inertia in rolls about the longitudinal axis and therefore slower recovery from lateral disturbances. Incidently, slower recovery means a greater loss of altitude




● SEE PAGE 43!

in order to bring about recovery of equilibrium.

It is evident from these facts that the tandem pusher type of model cannot compare with model No. 1 for stability. The biplane and triplane arrangement of this type will have the same characteristics for all structural features are the same except for the wing arrangement. In fact, this change in arrangement will cause greater inertias and moments about the C.G. and a consequent loss of stability. In still air they will be very steady, but turbulent air will make them proportionally unsteady.

Due to its large inertias and remote location of weights the twin tractor is very much like the tandem pusher models. The only advantage it possesses is that a comparatively small landing gear can be placed at the nose to insure a low C.G. relative to the C.L. and a high line of thrust relative to the C.G. Because of this the C.G. will be brought well forward and a long tail moment arm can be obtained. Also, the gliding characteristics will be nearly perfect due to the C.G. being below the C.L. The great drawback to this type is its large inertias due to remote weights. This makes the twin tractor, monoplane, biplane or triplane an extremely difficult type of model to stabilize. Very large tail surfaces and a very low C.G. are usually necessary to have it fly at all.

The tailless plane is our next consideration. As the name infers, it has no tail and therefore the weights are concentrated near the C.G., but on the other hand it lacks the stabilizing effect of a tail surface. In this type of ship the wing tips are actually the tail surfaces. The sweptback wings bring the tips to the rear of the C.G. and when they are turned up, they have the effect of a negative tail. Their distance to the rear of the C.G. is very small, however, and such a plane has all the bad qualities of a close coupled ship. It is not only erratic due to this, but once it starts to swing about the vertical or longitudenal axis, the large weights, remote from the C.G. at the wing tips, induces severe spinning characteristics. The heavy wing tips are caused by the weights of the rudders and elevators being located on them, as you probably realize. One should not even consider this type for a "stability" model.

The only other types that might be discussed are the foregoing types equipped as hydros or as flying boats. Obviously the addition of floats increases the inertias of all types and adds the complication of "floation" (static) and "take off" (dynamic) balance. The air resistance of the floats far below the line of thrust also causes disturbing moments of great magnitude and variation under varying degrees of power.

The obvious point concerning this discussion is the great superiority of the single propeller tractor for a "stability" plane. Its simplicity adds conviction to our choice of this type to fulfill the purpose for which it is to be designed.

Next month the required size of the model, its structural arrangement and the comparative size of the aerodynamic factors will be discussed. Until then, "happy landings."

## Gas Lines

*(Continued from page 9)*

Mr. Moyer says that he no sooner completes a gas job when someone wants to buy it. Therefore, he cannot keep track of all their flights. However, he kept a log of one model he built in 1933 and, up to the time it was sold, it made thirty flights ranging from three to thirty-five minutes; with a total time of three hours, ten minutes in the air. There was only one minor crack-up when the model landed on a stone fence. The landing gear was washed out.

Mr. Moyer is one of the latest members of the I.G.M.A.A.

Thracey Petrides of 719 West 180th Street, New York City, sends us picture No. 8, showing his 8', 3", span gas job. He has made forty-one flights with it to date. The ship weighs five pounds.

William Effinger, Jr. of 53 Berkeley Place, Brooklyn, New York, one of the pioneer gas model builders of the east, has brought out a very sleek-looking low-wing which is shown in picture No. 9. He says:

"The ship was flown exactly as shown in the picture and performed beautifully. She took off in about fifteen feet unassisted and began to circle the field at about 45 m.p.h. The engine was barely turning over. She should do about 65 m.p.h. at full

throttle. I designed the ship and it was built by Thracey Petrides."

It would be quite interesting to readers if builders who calculate speeds would state in an exact and scientific manner exactly how these speeds are calculated.

Marvin Bradley of 506 Sierra Bonita, Hollywood, Calif., is responsible for picture No. 10, which shows us one of his recent six foot gas jobs.

Conrad Hansen, Jr. of Hangar No. 13, Y.M.C.A., Beloit, Wis., sends us picture No. 11. This picture is typical of scenes in which gas jobs are featured. It shows members of the club waiting with patience the warming up of the engine. Some difficulties seem to be holding the attention of the mechanic.

Gas model activities started fifteen months ago, when the club was presented with a Gil motor. However a Brown Jr. was purchased. This was mounted and on its initial flight the model stayed up two minutes. Later in the day another flight of five minutes was made. At the present time activity is well under way preparing for the coming summer contests. Four small gas jobs are now being built.

The club boasts a membership of fifty boys.

W. Keith Goodwin of 512 West South Street, Angola, Indiana, sends us picture No. 12, showing his cabin type gas job. The interesting part about this model is its landing gear, which has telescoping brass tubing with rubber band shock chord for the shock struts. It has landed on ploughed ground several times with absolutely no damage to the landing gear or model.

Many builders have built gas jobs to the exact scale of larger ships. This is one of the advantages of gasoline powered models. Jack Knowland of 1006 West 12th Avenue, Vancouver, B.C., Canada, is one of these young men. Picture No. 13 shows his B/J Army Pursuit ship which is powered with a Brown Jr. engine. It has a six foot span and weighs five and a half pounds complete. Knowland says:

"It is the first gas job in Vancouver, but it will not be the last for Vancouver has gone 100% gas jobs. There is going to be a big gas job contest here next summer, during our Golden Jubilee celebrations. Probably some of the boys of the West Coast in the United States would enjoy attending this contest."

Knowland is one of the members of the I.G.M.A.A. from Canada.

Picture No. 14 shows a KG with a ten foot wing span, built by Pelham R. Burnett of 660 West 180th Street, New York City. He says the only fault he has to find with the KG is the thickness of the wing and tail surfaces and the weight.

The ship has been designed with thick surfaces in order that it will fly slowly and crash more gently. This weight is due to the fact that this design was made with the idea of using a ⅓ to ½ horsepower engine. It is suggested that Burnett try a larger engine in this ship. It is one of the few ships that will stand up under high power.

Picture No. 15 is a K.G. model taking off. Believe it or not, it is one of the many KGs built in Australia by the Model Flying Club, under the guidance of Mr. Ivor Freshman. This ship, built by H. Gerrzo, is making an unusual take off. We wish to commend the photographer.

Picture No. 16 shows E. Whitney, left, with another KG waiting for his turn to fly it; and J. Best, on the right, with his gas job.

A call for help comes from Clarence Anderson of P.O. Box No. 24, Bellaire, Texas. He writes:

"In reply to your editorial 'What Do Gas Models Mean to You,' I wish to say something about the enthusiasm toward gas models down here in the South. I live just outside of Houston, Texas, one of the biggest cities in the South, and I enter all of the contests in the city.

"I won a gasoline engine in a recent contest which was the first one in Houston. A gasoline model is the one goal of every model builder in Houston and yet there are none here in this large city.

"We model builders down here have no support whatsoever. We have no model club in the town and no one to sponsor a real club. I am sure that if we had more support we could hold some of the model airplane records.

"I think gasoline model building is a marvelous activity and should be continued. It seems to be the step between model building and real airplane building. I am sure that the knowledge gained in building gas models would be a great help in designing full size planes.

"I would sure like to hear from you as to what we should do in the South to raise the enthusiasm of the people enough so that they would sponsor our model airplane activities.

"If you would give me some idea about this, I would see that they were carried out. Thank you."

We suggest that Mr. Anderson and his associates all join the I.G.M.A.A. Possibly with ammunition such as is being provided in "Gas Lines," he may be able to interest

the Chamber of Commerce or some other public spirited businessmen of his community.

We have word from Mr. George H. Warden of the Pennsylvania Technical Institute, P.O. Box 162, Hughesville, Pa. Mr. Warden is Manager of the Pennsylvania Model Aircraft Laboratories at P.O. Box 16, Locust Dale, Pa. Builders in the vicinity of Pittsburgh interested in model matters may get in touch with Mr. Warden at Locust Dale and those who wish to get in touch with the Institute for information concerning matters on aeronautics should write Mr. Hall at Hughesville.

Mr. Warden writes us that the I.G.M.A.A. will have his utmost cooperation for development of this Association and the "Gas Lines." Mr. Warden is a member of the Association.

A list of applications for the I.G.M.A.A. follows. If anyone wants the address of a member in his community or locality, write to us.

Honor for first active membership and first unit membership belongs to Mr. Allan Turner. Other members are: Henry Koch, Fred Knoll, Rex Richards, Martin Lihl, J. G. Wheeler, Bob Tulga, Aloin Wilson, Bernard Sturmak, Ernest Rothert, James Soukup, Stanle Becher, Donald Williamson, G. Carrington, Frank Blien, Richard Miller, Roscoe McCrea, Gene Stephens, Leonard Grignon, Courtney Shaw, Elbert J. Weathers, Carl VanCourt, Conrad Hansen, Robert More, Jack Kapsol, Parks Newson, Jim Stevenson, John Knowland, Ellis Weiner, James Rothrock, Frank Lawton, Matthew Balaz, Rolland Fetters, Wendell vanDeinse, John Millar, Walter Kutaj, James Hoogens, Albert Distefano, Norman Brandman, Seymour Brandman, Sol Lamberg.

If anyone has a spare KG3 that they are not using, without engine, will they kindly let Mr. Grant know care of the I.G.M.A.A., 551 Fifth Avenue, New York City.

## Frontiers of Aviation

*(Continued from page 17)*

the DC-2, carry four engines and a crew of five (pilot, co-pilot, radio operator, stewardess, and porter). As a sleeper it will carry 20 passengers. Specifications are as follows:

Wingspread—135 feet
Overall length—95 feet
Weight—50,000 lbs. plus
Horsepower—4 engines, 4,000 hp.
Top speed—200 m.p.h.
Cruising speed—180 m.p.h.

The Douglas company has also made public, details of their XFD-1 Navy scout bomber. It has a top speed of 211 m.p.h. and a climb of 1970 f.p.m. Service ceiling is 27,200 ft. 332 lb. of bombs, one movable and two fixed machine guns are carried.

Specifications of the DC-3 exhibited at the National Pacific Aircraft and Boat show follow:

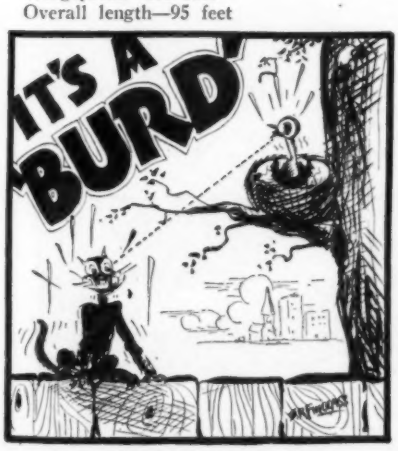
Gross weight—24,000 lbs.
Top speed—215 m.p.h. at 10,000 ft.
Cruising speed—190 m.p.h. at 12,000 ft.
Landing speed—65 m.p.h.
Cruising range—1,100-1,400 miles.
Engines—Curtiss-Wright Cyclones of 850-930 hp. each.

Douglas' closely affiliated company, Northrop, has orders on hand that will keep them busy for the next two years building military planes. Many new types are in process of design. Recently completed is a low-wing attack plane powered by a double-row engine and with a completely retractable landing gear for the Army Air Corps. Top speed is 250 m.p.h., cruising 220 m.p.h.

The radial engine has apparently reached its limit as to horsepower, or will do so when the 1,000 hp. mark is reached is many experts' belief. It will be in the development of the in-line and v-type engines that further horsepower may be obtained. In this category one of the most promising companies is the Menasco Manufacturing Company, Los Angeles, Calif. The company has purchased sole manufacturing rights of almost every in-line engine in this country. Included are such popular engines as the Cirrus type. For over eight years Mr. Al Menasco has been developing the famous Menasco engines that have powered so many of the popular racing planes in this country. The small but modern factory of Menasco's is filled with constant activity, and an expansive program is now under way, but details are secretive at the present time. Shortly however, we may be able to bring to you details of some of the new engines which promise to possess astounding performance. There are infinite indications that the Menasco company will become one of the largest aircraft engine manufacturers in the world.

Among the comparatively new Menasco products are the B6S "Buccaneer" and the C4S "Pirate" engines. The "Buccaneer" is a six-cylinder inverted in-line air-cooled supercharged aircraft engine rated at 200 hp. at 2250 r.p.m. at 4,500 ft. elevation. The "Pirate" is a four-cylinder engine of the same type rated at 150 m.p.h. at 2260 r.p.m. at 3000 ft. elevation. Others on the production line are the 95 hp. B4, the 115 hp. C4, the 160 hp. B6 and soon there will be one of about 250 hp.

The new Burnelli six-place sport plane that has been designed for the Bureau of Air Commerce competition for a small twin-engined sport plane is to be powered by Menascos so the Burnelli company made public. The design of the plane, which much resembles the Burnelli 14-passenger plane built last year in general appearance calls for Menasco B6S engines.




● SEE PAGE 43!

We shall bring you further news next month on planes entered in the Bureau's competition. It has been rumored that Kinner, Grow-Joy, Bellanca and Lockheed have been other manufacturers that have contributed designs for the competition.

Construction details on the new Lambert trainers are as follows: The wing structure is of novel wooden spar design, wooden ribs of beam type with plywood covering on leading edge. Wings rigidly braced in torsion with double internal tie rack and box compressed struts. Fabric covering Ailerons of balanced Frise type, differentially operated, of wooden construction with fabric cover. Airfoil section of late N.A.C.A. series, with semi-elliptical plan form. Wings readily detachable and interchangeable in open and closed models.

The fuselage is of welded steel tubing and interchangeable on open or closed types. Only upper fuselage fairing, windshield or cabin enclosure are different on open and closed models. Cockpit seats are adjustable up or down.

Features on the deluxe closed Lambert plane include metal propeller, N.A.C.A. cowl, swivel tail wheel, electric starter, light equipment, flares, radio, and wheel pants.

It has been said that Sikorsky is preparing to build a new low-wing monster bomber! The plane is to have four engines of unusual high horsepower and will have a wingspread of 210 feet! It will be the first land plane that Sikorsky has built in many years. Lockheed is now developing a Navy ship.

## How to Build a Scale Model of the Giant Douglas Sleeper Transport for 1936

The cost of the new Douglas sleepers being built for American Airlines is about $112,000 each, but to build a scale model of the ship as described below, it will only cost you about $1 for the necessary material. Get dimensions from plans for purchasing stock. Balsa wood should be used. The accompanying plan may be squared off by joining the corresponding dots on border with straight pencil lines. Each square will equal two feet. The wheels for the landing gear should be purchased.

Draw the outline of the fuselage on stock and cut with a jig or band saw. Go over surfaces with coarse sandpaper and then draw on top view of fuselage. Cut around this outline also with accuracy. Then, using a sharp chisel, round out the fuselage as shown by the cross-sections on plans. Go over the surfaces with coarse and then fine sandpaper until a smooth finish is obtained.

The wing is to be made in three parts, the center section containing the engine nacelles and the other two sections containing the ailerons. Draw the outlines of the parts on stock with the grain of the wood running lengthwise. Taper down the wing parts with a chisel as shown by the front view and then shape out the airfoil as shown by sections F-F and G-G. Sandpaper the pieces thoroughly and cut slots in the leading edge of the center section for the engine nacelles to fit. The wing fillets may be made later during assembly if you wish.

Pressing heavily so as to make a groove in the wood, draw on the ailerons on top and bottom of wing pieces and the split trailing edge flaps on the bottom only.

The tail surfaces (rudder, fin, stabilizer and elevators) may easily be cut from sheet balsa with a razor blade. Sandpaper these down with fine sandpaper and then draw lines as you did for ailerons separating the stabilizer from elevators and fin from rudder. Also draw on the tabs.

In making the engine cowls and nacelle, draw the side view and cut and then the top view and cut. Round out the bocks with your razor blade, leaving the sides flat where they join wing. Hollow out the bottoms so wheels may be enclosed when retracted as shown on plans. Sandpaper the nacelles to smoothness.

Cut the landing gear struts from strips of scrap wood with your razor blade.

The blades on the propellers may be carved out separately and then cemented together at the hub.

Go over all parts with fine sandpaper once more and then begin the paint job. Many coats will have to be applied. Do not apply a second coat before the first has dried thoroughly. Paint the entire plane silver except for the red trimmings shown on plans. Windows should be painted white and engine and wheels black. The upper windows are for the upper births when the plane is used as a sleeper.

After the paint has dried thoroughly,

begin the assembly. Cut groove in bottom of fuselage to fit center section of the wing. when this is done, cement the section in place. Join the nacelles to the wing section applying plenty of cement. Lay the fuselage on a flat surface and connect the other two wing parts. Use plenty of cement. Lay blocks under the wing tips to give the wing the correct dihedral angle.

Cement the tail sections in place with care and accuracy. When joints have dried, lay the model on its back and cement the landing gear in place. The propellers may be joined using straight pins as shafts. The wing fillet, the fairing that joins wing to fuselage, may be made with putty. Touch up all parts with paint and cement and then the model will be completed.

## Building the Hawker Single Seater Fighter

*(Continued from page 11)*

two wing ribs are 1/16" sheet. All the remaining ribs are 1/32" sheet. The tubing and the bracing shown on the second rib are an integral part of the retractable landing gear and must be located as shown. The spar is cut to the depths shown by the rib notches. It is also made from 1/16" sheet. Cement the ribs in place on both the right and left wing spars. The first rib is slanted to allow the desired angle of dihedral. The leading edge is of ⅛" sq. The trailing edge is shaped to a pointed cross section from ⅛"x¼". The tips are bent to shape from 1/16" bamboo. The section between the first two ribs is covered with 1/32" sheet. It is necessary to cover both top and bottom surfaces at this section in this manner. The lower surface is cut out as shown on the wing plan to fit the shape of the landing gear struts when retracted. A small piece of the spar also is removed to allow the retraction of the rear landing gear strut. The inner hinge, the detail of which is given, is attached to the top of the spar at the station designated. Cement and bind this hinge in position.

Cover both sides of each wing panel with an individual piece of tissue. The finished covering is lightly sprayed and doped. Three inch English circles are attached as shown. Mark the outlines of the ailerons with black tissue. Glue each wing panel firmly to the stub rib and check for dihedral and incidence.

The air scoop and radiator tunnel blocks are shaped as shown and cemented to the lower surface of the fuselage as seen on the side plan.

### Landing Gear

The main struts shown on the side view are of ⅛"x⅜" and ¼" respectively. They are assembled with the 1/16" aluminum tubing and .014 wire hinges in position. The portion of the landing gear that is seen on the side view swings up and inward to the retracted postion. The inner strut is of ⅛"x⅜" and is built in two hinged portions as shown in detail. The wire and tubing that serve as hinges are cemented and bound in position. The movements of the struts are marked by arrows and the retracted postions are designated by broken lines. Eyelets are inserted in both portions of the strut to hold the wire lockpin. This holds the strut rigid when extended.

The wheel covers are made of 1/16" sheet. Each wheel cover is built up of two semi-circles hinged to each other by a narrow strip of paper. The lower half of the cover is moved into position to cover the wheel when it is retracted. The axles of .028 music wire are bent at right angles and imbedded in the wheel cover along the line of the main strut. The wheels are 1¾" in diameter and should be of a thin cross section.

### Propeller, Motor and Plug

The propeller is cut from a block 9"x1⅛"x1¾". The tips are not rounded until the blades are completely carved and sanded. The rear face is cupped about 3/32". The main propeller cone is cut to the dimensions shown in the detail and cemented in place. Note that the cone is made in two pieces both of which are fitted to their particular side of the prop hub. The smaller front cone is one piece and is attached after the .028 wire shaft has been bent and imbedded in the propeller hub. A ⅛" washer slides over the shaft and is glued to the rear face of the hub.

The nose plug is cut as shown on the top and side views from a piece 1¼" in diameter. The stock required is ⅛" thick. Small stops are made from ⅛" sq. and are cemented in position. A small tin bearing is sunk into the face of the plug and serves as a bearing. Place the finished plug on the shaft before bending the hook.

The motive power is eight strands of ⅛" flat rubber.

### Flying the Model

If possible, test the model over grass. As an alternative, fly the model R.O.G. on a few turns. As the correct balance is ascertained, increase the number of turns. The stabilizer surfaces may be slightly warped up or down along the hinge line to suit the condition. Use a small weight if necessary. As workmanship is bound to vary, especially in carving the nose block, the model built is likely to differ from the original in balance.

### Bill of Materials

1—3"x1/16"x36" sheet balsa
1—3/32"x2"x3" sheet balsa
1—2"x18"x1/32" sheet balsa
1—3"x24"x1/32" sheet balsa
1—⅛" scrap sheet balsa
7—1/16" sq. x 36" strip balsa
2—3/32" sq. x 36" strip balsa
1—⅛"x¼"x36" strip balsa
1—⅛" sq. x 24" strip balsa
1—4¼"x3-1/16"x2⅜" block balsa
2—1⅜"x1¼"x1⅛" block balsa
1—2-7/16"x1½"x⅝" block balsa
1—9"x1⅜"x1⅛" block balsa
1—1-1/16"x⅜" sq. block balsa
2—⅜"x1-3/16" sq. block balsa
1—⅜" sq. x 5/16" block balsa

**Miscellaneous**

1—1 oz. cement
1—2 oz. clear dope
2—white tissue
2—flat bamboo
10 ft. ⅛" flat rubber
1 pr. 1¾" wheels
1—⅜" tail wheel
1 ft. .028 wire
1 ft. .014 wire
6"—1/16" tubing
insignia
cellophane

### Secrets of Indoor Design

*(Continued from page 7)*

of the pipe or soldering iron at the same time that it is bent downwards. The pipe or soldering iron must be very hot in order that a bend without creases may be secured. By using this method one may also secure perfect halves for an elevator. A complete elevator may be made in ten minutes.

Balsa wheels are easily made by wrapping a thin strip of balsa having the cross section of the wheel rim around the hot pipe or soldering iron, cutting off the excess balsa and joining the ends of the rim with cement. A single spoke, glued to the rim joint and the point diametrically opposite on the wheel rim, is sufficient for the strength required.

In selecting balsa for bending, one should remember for what part of his structure the finished piece is intended. If it is a wing tip of small radius, a light balsa with hardly any perceptible grain should be used, otherwise creases may result. In choosing wood for an elevator which has tips of large radius, a stiffer balsa piece should be selected, as the inside portion of the bend will not be compressed much.

Probably the most inconspicuous part of an indoor model is the thrust bearing. This little part has done a great deal of harm in preventing a builder from obtaining as good a flight as his ship is capable of. If it is the slightest bit weak, it will bend under the force of the twisted rubber and change the direction of the line of thrust. The flight will become very erratic and the ship itself may seem to be unstable. This annoyance can be dispensed with if the proper size wire is used, that is if a wire thrust bearing is employed. For a baby R.O.G. using 1/32" flat rubber, the .014 size wire is sufficient, and for a class C tractor the .016 size should suffice. A dural bearing is excellent for the purpose as it has a great resistance to bending and is self-lubricating.

Wing clips may also prove to be sources of annoyance at times. If they are not made from the proper grade of balsa, they will twist when the model is under full power and cause the model to dive. A tractor model built by the writer which had done nineteen minutes with strong clips, turned in a maximum duration of only twelve minutes when weaker clips were substituted for the original ones. They twisted at the beginning of the flight and caused the wing to wash out. This in turn caused the model to

circle in an opposite bank and prevented it from climbing. Part of the trouble was also due to the use of .010 wire for the metal part of the clip. For this purpose an .014 size should have been used. Too much caution against the use of weak clips cannot be given because the disappointment that these seemingly insignificant parts may cause is readily avoidable.

At the Bamberger Aero Club Model Builder's Convention which was held in Newark, N.J., on September 14th, a number of interesting points concerning indoor model contests were discussed. Mr. Victor Fritz of the Philadelphia Model Airplane Association mentioned a specific case where an indoor tractor after coming down deadstick to within a few feet of the Lakehurst dirigible hangar floor, caught onto an air current and was lifted with the dead prop to the top of the hangar. The added duration was eight minutes. This story seemed to be doubted by most of the builders present, but it was verified by another builder who had attended the contest in the hangar. Mr. Fritz made the suggestion that, in order to avoid such occurrences and to rid contestants of that element of luck, a weight rule be applied to indoor models just as it has been applied to outdoor ships. This suggestion seems to be a good one and it is a fact that durations which the light indoor models now obtain may be obtained easily with ships that have greater wing loadings. The power loading will naturally have to be increased, but this does not mean that the duration will be lessened.

Mention was made in previous articles of a twenty-two minute ship built by the writer. This ship was heavier than most of the indoor models as it had an excess of ⅛" flat brown rubber. It also possessed a reserve of power, but nevertheless the propeller was slower than any other at the contest. This example is given just to show that lightening the weight of a model is not the only way to increase duration. It will be interesting to note what steps are taken to bring about the weight ruling for indoor models.

### Building a Midget Racer

*(Continued from page 22)*

order to tighten the rubber), point the model down (about 5 degrees) and give it a very gentle push. Note what happens. If the model stalls (that is, if it goes up on its nose and then falls back on its tail) you will have to bend the back of the elevator down. On the other hand, if the model dives you must bend the elevator up. If the model turns to the right you will have to turn the trailing edge of the rudder to the left and vice versa. The model might side slip. A side slip happens when one wing falls below the elevation of the other. The model moves side wise. This is corrected by warping down the trailing edge of the low wing. Well, when these corrections are made the model should have, as a result, a straight and sweet glide. So far, so good. You then have to test with "power on."

At first only a few winds are given the rubber. The model will probably fly perfectly. However, if any of the above symptoms are noticed correct them in the same manner. A loop can be "taken out" of a model the same as a stall is. For a full flight give the rubber not more than 175 turns unless lubricant and a winder are used.

Lubricant can be bought from the more advanced model airplane dealers. Keep this in mind about lubricant. Use very little and rub what you use into the molecules of the rubber as much as possible. A lubricated motor is considerably better than an unlubricated. Lubrication and the use of a winder will push up the number of safe turns from 175 to 600. Quite a difference. And if brown rubber is used the safe number of possible turns will be 750. Of course you have to know how to wind

### List of Materials:

1 3/32" medium balsa, 2" x 14" wing.
1 ⅛" hard balsa, ½" x 10" fuselage.
1 1/16" medium soft balsa, 2" x 8" tail surfaces.
1 Steel thrust bearing, .025" hole.
1 .024" music wire, 18" long, landing gear, rear hook, shaft.
1 Machine cut propeller, 5" diameter.
3 Brass washers, ⅛" diameter.
2 Hard wood wheels, 1" diameter.
1 3/16" flat rubber, 16" long, motor.
1 Colorless cement, ½ oz. bottle.

## An All Weather Contest Fuselage Model

*(Continued from page 22)*

quiring 19 ribs. Because of the tapered wing, the ¼ x ⅛ center spar must also be tapered.

Pin the center spar and trailing edge on the plan, insert the ribs and allow the cement to set, then add the ⅛ square leading edge. Cement on the bamboo tips, let dry. Remove pins and place 4 inches dihedral under each tip.

### Tail

The tail is constructed like the wing, except that a Clark Y airfoil is used, and no dihedral is added.

### Propeller

The propeller is carved from a block 1 x 1½ x 12. For other details see plans.

### Covering

The fuselage is covered with light 1/32 sheet and sanded to about 1/40. Give the fuselage one coat of clear dope and sand with 10 nought sandpaper.

Cover the wing and tail with Japanese tissue and spray with water. When the wing and tail surfaces are dry, apply two coats of clear dope.

### Flying

The model requires 12 strands of brown rubber. Select a large field. Glide the model a few times to see if it is properly adjusted. Then lubricate the rubber and wind about 300 times for a trial flight. Launch your model. It will climb to about 75 feet, circle a few times and glide down to a perfect three point landing. Now put about 900 to 1000 turns in your rubber and launch your model.

Now prepare yourself for a cross country run and a stiff neck.

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## Navi-Goid

*(Continued from page 27)*

this one, plotting it from your last position.

(1) TIME: 9:00 P.M., Tuesday.

(2) ALTITUDE: 10,000 Feet.

(3) AIRSPEED INDICATOR READING: 100 m.p.h.

(4) GROUNDSPEED: Unknown, due to storm.

(5) DRIFT: Unknown, due to storm.

(10) MAGNETIC COMPASS BEARING: 255°.

Now, (6) DEVIATION, (7) VARIATION, (8) CHART and (9) SCALE OF MILES will naturally be the same as last time. However, in addition, a weather report came in from the AZORES that a 40 miles per hour windstorm was blowing due north. Let's see you work out that one."

"I don't believe I can."

"Well, do as much as you are able, and I'll explain the rest."

"All right. *Time* is:

9:00 P.M., Tuesday.

5:00 P.M., Tuesday. (Last Position)

---

4 Hours of Flight.

"The *Altitude* is 10,000 feet, and the *airspeed reading* was 100 m.p.h. Since you are to add 1¾% of the airspeed *shown on the dial* for every thousand feet of altitude:

1¾% equals .0175

10x.0175 equals .175 so,

100

.175

---

500

700

100

---

17.500

plus 100

---

117.5 m.p.h. TRUE AIRSPEED.

"Now, since the magnetic compass reading was 255°, and the variation was 15° Westerly, 255°—15°=240°. 240° is the *true bearing*, from the last position. That is the direction we would go if there were no drift. But there is a drift. If you can't use the Drift Indicator, because of the storm, how can you find the drift, Captain?"

Captain Carroll nodded thoughtfully. "It *is* possible, though. You see, the weather report mentioned a 40 m.p.h. wind blowing due north. Now you have found your *true airspeed* to be 117½ m.p.h. So now, look at this *table of wind and drift* (Figure "NN"). You have the nearest *true airspeed* column at 120 m.p.h. Go down that column until you come to the wind speed of 42 m.p.h. Now, if your true airspeed were 120 and your windspeed were 42, the drift would be 19°. However, your airspeed is a fraction less and your windspeed is a fraction less, so your drift would be more accurately 18°. Not so hard, eh?"

"Gee, no. With the table, it's easy. But how about the difference between the *true airspeed* and the *actual airspeed?*"

"Well, here is the actual direction that you have flown." With the aid of the protractor, the Captain drew a solid line on the 258° (240+18°=drift 258°) degree. Then another on the 240° line. "And this is the course you would have flown had it not been for the drift."

"Now, the wind is blowing *from* the South (called blowing due North). As I have explained before, the pilot is pointing his fuselage on his magnetic compass course (255°) which is a true bearing of 240°, (Note Figure "OO"), although the plane is progressing along the 258° line. In other words, it is flying more or less sideways.

"Then, the wind will retard the plane's flight to the extent of the angle . . . . . this time the angle is 60°. You see, if the wind

were blowing from the front, it would retard the plane's flight 40 miles per hour. However, since it is blowing at only a 60° angle, it only retards the plane's flight ⅓ of its (the winds) full force.

90° (Full right angle)
60° Angle of Depreciation.

---

30° Angle of Wind Strength
30° is ⅓ of 90°.

Therefore, ⅓ of 40 m.p.h. is approximately 13 miles. So, if the *true airspeed* was 117½ m.p.h., and the *wind speed strength* was a headwind of 13 m.p.h., then 117½ —13=104½ m.p.h., which would be the *actual airspeed.*"

"Gee, that's fine," the youth voiced his approval.

"What's next now?" the Captain questioned.

"Well," the youth began, "The true path of progress or course was 258°. The actual speed (groundspeed) was 104½ m.p.h. And the time of flight was 4 hours. So 4x104½=418 miles flown. 418 miles is 6°05' Latitude. (Figure "MM"). He took his dividers and measured the distance on the chart. "So," he declared excitedly, "There is the second position."

WATCH FOR THE NAVI-GOID CONTEST BEGINNING NEXT MONTH.

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### Airways Here and There

*(Continued from page 32)*

The advisor of each chapter or unit is in direct charge of awarding the above commissions. It may be handled in any way he or she deems advisable. As soon as a commission has been granted, and the Junior Aviator Headquarters notified, a certificate will be awarded. If a boy or girl is capable of building a model that can fly twenty-five minutes or a solid model gaining eighty-five points for pure construction, he automatically becomes an ace regardless of his previous commission. It is not necessary to take the commissions in the order listed.

At present the Cleveland Squadron plans to hold four city wide contests this year. They are to be held on the following dates:

January 11—City-wide indoor flying contest—Public Hall.

January 25—City-wide solid scale model contest.

April 6—Thirteen City-wide solid model contest.

May 16—Outdoor Model Contest. Winners in this contest are eligible for the Junior National Air Races in August.

In the solid model contests, it is planned to have a division for models built from boxes or scrap wood found in basements, etc. This will enable every boy or girl, regardless of finances, to participate in contests and win awards.

In order to aid model building members of the organization, the Junior Aviator Squadrons sponsored by Scripps Howard Newspapers throughout the country, publish plans for building beginners' and contest models every Saturday. Previous to every contest, thousands of plans for models eligible, are printed and given away free to members.

The Cincinnati Post Squadron reports a membership of over 11,000 and more are joining every day. A recent local contest included an event for girls. Miss Edith Lackner, famed Ohio woman pilot, donated a trophy for this event.

The Indianapolis Times Squadron, of which Vernon Boehle, James Cahill and Robert Huddleston, winners in almost every National Contest, are members, are planning a series of indoor contests which will be held at the Butler College field house. It's just about the best place for indoor flying in Indianapolis. The squadron is composed of 15,000 members.

The Denver Squadron sponsored by the Rocky Mountain News is planning activities that will double its membership. They are bidding as the site for next year's Junior Aviators national contest.

More than 150 members of the Akron, Ohio, Squadron attended a showing of the film "Safety on the Federal Airways." Many similar meetings along with contests are planned for the year's Junior Aviator program. The Akron Squadron boast of a membership of over 25,000.

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In order to stimulate competitive interest among members of the classes in model building in the public schools of Newark, New Jersey, Mr. John Hulstrunk, activities director, puts up weekly prizes of model supplies and kits. A different contest is held each week and the grand prize is awarded at the end of the month for the most consistent winner.

Daniel Dommasch, 307 E. 86th Street, New York City has begun construction of an eight foot gasoline powered model which he intends to power with a baby cyclone engine.

Hubert Owens of Memphis, Tenn., has built a six foot model weighing sixteen ounces powered by a dry ice and carbide engine. He reports many successful flights with it. The model is a near scale of a monocoupe.

### Connecticut Model Airplane Contest

The Connecticut Model Airplane Contest will be held as usual this year. Mr. Alfred Schmidt of 29 Vernon Street, Hartford, Conn., writes and asks all model builders throughout the states of Connecticut, Mas-

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## To Miniature Gas Motor Owners

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sachusetts and Rhode Island who wish to enter this contest to get in touch with him at the above address immediately.

### "The Soaring Cycle"

A publication which should be of interest to many model builders is "The Soaring Cycle." Anyone who wishes to receive, free, copies of the first two issues of this interesting treatise on soaring, may write to The Soaring Flight Company, Departmental Bank Building, Washington, D.C.

### Junior National Aeronautic Association

On March 10, 1936, the Fresno unit of the Junior N.A.A. will celebrate its third anniversary at a meeting to be held at our local headquarters in the Hotel Fresno. In view of the fine work which the Fresno boys have done, their president will appreciate a few words from national headquarters which will offer encouragement and prove to these young men that Washington is still interested in their young American followers.

This chapter has been recognized as the first Junior chapter of the N.A.A. to be organized in the United States, and it was the local group who went on record as opposing the Bingham plan to do away with the Junior rating. Our members have done a fine bit of work, and have been taking an active part in civic affairs of Fresno.

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APPLICATION FOR MEMBERSHIP IN THE AIR WAYS CLUB

Please enroll:

Name .....
Address .....
Number of Models Built .....
Type .....
Date .....

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### Aviation Advisory Board

*(Continued from page 26)*

Question: Is the stabilizer and rudder area determined in the same manner for a model sailplane as for a rubber-powered model?

Answer: No, the values of the areas of the tail surfaces of a model sailplane should be one-third to forty per cent less than in the case of a rubber-powered model, for equivalent wingspans. This is due to the fact that the propeller generates a torque that causes the tail to swing and prevent the recovery of the model from any disturbed position of flight. A greater area must be used for propeller models in order to overcome propeller reactions. However, formulae given for tail surfaces should be used in this case, for the wing span of several planes is usually excessive and the wing span affects the amount of wing area; the greater the wing span, the larger the fin must be. The fin of a sailplane should be approximately fifteen per cent of the wing area when the aspect ratio is in the neighborhood of ten or twelve. More area than this even may be necessary.

Question: Can the same model be entered in the stick model contest and also in the fuselage contest when wheels are added?

Answer: No, the type of model is determined by the area of the greatest fuselage cross section compared to the length of the model, in which the length is the distance from the rear of the propeller hub to the extreme tip of the tail. The formula for the cross section area of the body for a fuselage model is $\frac{L^2}{100}$. This area must exceed the amount given by this formula. If it is less, then the model is classified as a stick model.

Question: In designing the KG-2 and 3, how was the airfoil designed?

Answer: The airfoil was developed by Mr. Grant and was designed so that it would give a high lift at a slow speed, and yet have a high lift to drag ratio. This airfoil section has proven on many occasions that it has fulfilled this intent well.

One young man writes us that the $\frac{D}{L}$ of his KG-3 gas model is eighteen. Those who have built this ship know that it flies quite slowly. This speed was desired for this ship because such a characteristic reduces the tendency for crack-ups. Also a slow ship is more likely to seek out and hold thermal currents of air upon which it can soar indefinitely.

Question: Would a model of the KG-2 scaled down to three-quarters be practical? Would any of its flying ability be reduced?

Answer: Yes, scaling this model down is exceedingly practical. Its flying ability would not be materially reduced. By doing this a faster climb would result. The gliding angle of the ship should be about the same.

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### The German Air Force in the World War

*(Continued from page 5)*

charge of the school representing the interest of the I. D. Flieg.-T. was responsible for the running of the school strictly on the lines laid down by the High Command. Flying instruction was under the control of the Chief Pilot employed by the firm. The efforts of each firm to obtain first-class instructors and lecturers promoted competition between the firms, which had a considerable influence on the efficiency of the schools. For a fee of eight thousand marks, the firms undertook to provide machines, instructors and free board and lodging for the pupils up to the second examination. It was obvious, therefore, that the company had a financial interest in preparing the pilots for the second examination in as short a time as possible. In the case of pupils who failed to pass the second examination the State paid fifty marks for each flight up to a maximum of thirty-five hundred marks. While a majority of pupils were officers, a large number of other ranks were also trained at the Militar Flieger Schulen.

Each instructor had six to ten pupils, whom he trained on two dual control machines and at least four machines for solo flights. In the spring of 1918, the member of flights on dual control machines had been cut down to thirty. Civilian flying instructors received a minimum pay of three hundred marks per month, plus a premium of two hundred and fifty to three

hundred and fifty marks for every pupil who passed the second examination, a large part of which premium was paid after the pupil had passed the first examination. In 1918, it was no longer customary to make deductions from the instructor's premium each time a pupil crashed. Flying pay of one hundred and fifty marks per month was given pupils dating from their first flight.

Those Vorratsschuler who were not sent to a Militar Flieger Schule received their practical and theoretical training at the Fliegerkompagnie der Flieger-Ersatz-Abteilung, where the whole of the course was in the hands of the military instructors. Flying instructors were always N.C.O.s. Owing to the non-existence of the premium and to the fact that private influence played an important part in the selection of candidates for those posts, the instructing staff of a Fliegerkompagnie was usually greatly inferior to that of a Militar Flieger Schule.

Air Parks were known as Flug Parks. As a rule pilots were sent to the Parks only after having passed the third examination; but in order to relieve the pressure at the Flieger-Ersatz-Abteilungen, pilots were sometimes allowed to pass some of the tests of the third examination at the Park. The first four tests, however, invariably were passed at the Flieger-Ersatz-Abteilung. Pilots who had furnished their training remained one to three months at the Park, where they practiced flying on the latest type machines.

Suitable pilots were selected for special training on single-seaters and twin-engined machines after completion of their course on two-seaters. The former were trained as scout pilots at the Flieger-Ersatz-Abteilung; pilots who flew at the front and wished to become scout pilots were sent to a Jagdstaffelschule or Pursuit Flight School.

Pilots of G-type machines were trained at the Geschwaderschule or Squadron School where formation flying was practiced to a very great extent. Pilots of R-type machines were sent to the Riesen-Ersatz-Abteilung or Giant Airplane Training Section. As a rule only pilots who had flown at the front were sent there.



After a stay of four weeks at the Beobachter Zug or Observation Course, of a Flieger-Ersatz-Abteilung; the observer pupil was sent to a Beobachter Schule, observers school, or an Artillerie Fliege Schule, artillery observation school. The length of the course was approximately eight weeks.

Apart from the Flieger Schutzen Zuge or Machine Gunners Course, at some Flieger-Ersatz-Abteilunger and Observers' Schools, no schools for machine-gunners existed. The training was similar to that carried out at observers' schools, as many machine gunners who had passed the one year course in service were afterwards given commissions as observers. In addition to the ordinary observers' course a very thorough training was given in machine-gunnery and aerial fighting.

Beginning April 1st, 1918, only officer-observers for artillery and long distance bombing flights, as well as wireless telegraphy operators, known as Bordfunker, for giant machines, were trained. The officers and wireless telegraphy operators went through an advanced course lasting four weeks in all branches of aviation wireless telegraphy work. It should be noted that before joining this school, the officers had already gone through a course of eight weeks at an Observer's or Artillerie Flieger Schule, and the wireless telegraphy operators had been trained from three to six months at a Nea Signals School. Only wireless telegraphy operators who could send and receive at a minimum speed of one hundred letters per minute were sent to a Flieger Funker Schule or Wireless Telegraphy School.

In addition to the pupils mentioned, wireless telegraphy mechanics, called F. T. Warte, were also trained at the Flieger Funker Schule. Their duties were to fit wireless telegraphy apparatus on the machines; to keep it tested and in order. The wireless telegraphy pupil mechanic took part in a number of flights until he was capable of tuning an apparatus correctly and of getting into communication in the usual way with the wireless telegraphy ground station, or Flughafenstation. The advanced pupil was also trained in communicating with his own station in spite of several interrupter stations working at the same time.

Two Offizers Lehr Abteilungen, called "Oflas", or Officers' Training Sections, trained on an average seventy officers per month. About two-thirds of these were observer pupils, the rest being trained observers sent back from the front.

The training of air mechanics was had by three ways. They could be attached to the first class mechanics; by a course at the Werfschule of a Flieger-Ersatz-Abteilung, or by a course at the works of various motor firms.

At the Werfschulen only a general training was given and there were seperate courses lasting as a rule four weeks for special classes of mechanics such as riggers, splicers and welders. Men who were attached to engine firms received special training in the type manufactured at the works. In spite of the fact that great care was taken to make the courses as complete as possible, the system did not appear to be satisfactory and there was a much felt

lack of good mechanics.

The airplanes chiefly in use at the Flieger-Ersatz-Abteilung were of many types, some of which have not appeared on the many lists of wartime machines. They consisted of the Albatros Type B and C I. to XII, Aviatik B and C; A.E.G. B and C, old Fokker two-seater biplanes; German Type B; Gotha B and C; Halberstadt Type B and C to 180 hp. Mercedes engines B.V.G. type B and CL to the 200 hp. Benz engines. Merkur type B and C; Rolands and Rumplers.

Pilots who passed the third examination had the following single-seaters at their disposal: Albatros type D.I to D.III; Fokker monoplane and old biplanes D.I to D.V; Halberstadt type D, with the 120 hp. Argus engine; old Pfalz and Roland Haifischs.

The Reserve Training Section or Flieger-Ersatz-Abteilungen, had schools located and numbered consecutively from one to fifteen at Altenburg, Schneidemuhl, Gotha, Posen, Hannover, Grossenhain, Braunschweig, which was transferred from Cologne in 1917, Craudenz, Darmstadt, Boblingen, Brieg, Kottbus, Bromberg, Halle and Konigsberg.

The Bavarian Military Flier Schools, which were the same as the Reserve Training Section in the rest of Germany, had four schools numbered consecutively at Schleissheim, Heustadt, Furth and Germersheim.

The following Flieger-Ersatz-Abteilungen were being built at the time of the Armistice, Furstenwalde, Weimar, Wurzen, Luckenwalde and Chemitz in West Saxony. Also at Muran in Waren, a training field was under development which had the war lasted, would have been the greatest flying center in Germany.

The Military Flieger Schulens conducted by private firms were as follows: A.E.G. at Niederneuendorf, attached to Flieger-Ersatz-Abteilung 1; Albatros at Schneidemuhl, attached to Flieger-Ersatz-Abteilung 2; Aviatik at Bork, attached to Flieger-Ersatz-Abteilung 3. D.F.W. had three schools of which the one at Leipzig-Mockau was attached to Flieger-Ersatz-Abteilung 6, the one at Leipzig-Lindenthal also to school 6 as was the one at Travemunde. The Gotha firm located at Gotha had a school attached to Flieger-Ersatz-Abteilung 3. Halberstadt located at Halberstadt was attached to Flieger-Ersatz-Abteilung 5. Hansa at Hamburg was attached to Flieger-Ersatz-Abteilung 1. Konder at Grossenhain was attached to Flieger-Ersatz-Abteilung 6. Their two other works at Nordhausen and Krefeld were attached to school 7. L. V. G. at Koselin was attached to school 8. N. F. W. at Leipzig and Rumpler at Muencheberg were both attached to Flieger-Ersatz-Abteilung 9.

The Flieger Beobachter Schulen or Observers' Schools were located at Fuerth, Gotha, Grossenhain, Hannover, Koenigsberg, Lager Lechfeld, Schwerin, Schleissheim, Stolp, Thorn and Warschau.

The Artillerie Flieger Schulen or Artillery Observers Schools were at Jueterbog, Libau and Grafenwoehr. The Wireless Telegraphy Schools or Flieger Funker Schulen, were located at Neu Ruppin, Schleisheim, Stolp, Warschau and Johannistral, while the Bombing School or Bomben Lehr Abteilung, was located at Frankfurt.

There were also two Bomben Verzuche Abteilung, or bombing experimental schools, which were located at Frankfurt and Doeberitz. Experimental and testing stations known as the Prufanstalt Und Werft, or called mostly P. U. W., were at Aldershof, which was by far the most important, and at Doberitz.

Aircraft depots and testing stations, known as Flugzeugmeistereien, were located at Aldershof, Charlottenburg and Bork. The motor schools or Motoren Schulen, were located at the following factories of engine manufacturers; Benz at Mannheim; Mercedes at Stuttgart; Maybach at Friedrichshafen; Oberursel at Reinickendorf; Argus at Cannstatt, and the Bosch magneto school at Berlin.

This then, was the organization laid out for the training of Germany's pilots, observers and mechanics. While the flying tests do not appear stiff in view of present day military or commercial requirements, this training contributed to their control of the air on several occasions.

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**WACO BIPLANE**
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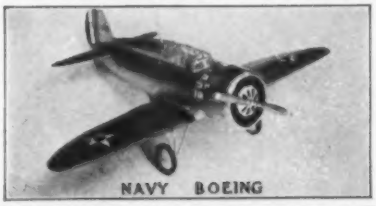
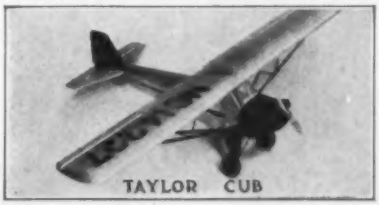
**NAVY BOEING**
Wingspan 10⅛". Length 7⅞". Yellow and silver.

**CURTIS HAWK**
Wingspan 11⅛". Length 8¼". Army plane, yellow and olive.

**TAYLOR CUB**
Wingspan 12¾". Length 8". A small non-flying model of the flier shown above. Red and silver.





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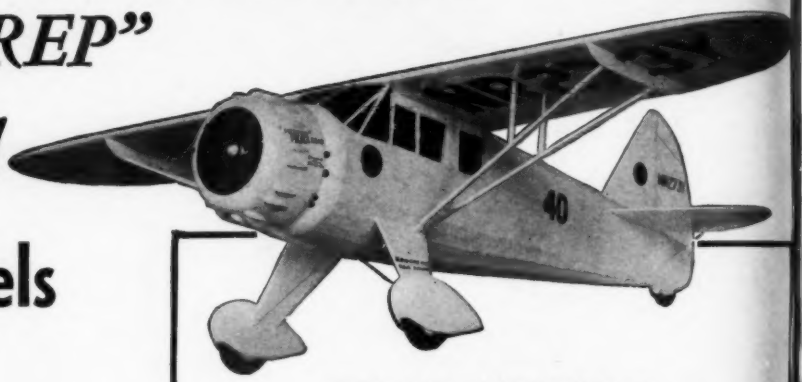

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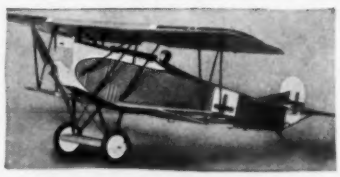
**20" HAWK P6-E**



**20" FOKKER D-7**

*Over 7000 of these three designs sold*

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